RESEARCH ARTICLE

Screening in the Era of Economic Crisis: Misperceptions and Misuse from a Longitudinal Study on Greek Women Undergoing Benign Vacuum-assisted Breast Biopsy

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Abstract

<u>Background</u>: To evaluate knowledge about screening tests and tests without proven screening value in a Greek Breast Unit population undergoing benign vacuum-assisted breast biopsy (VABB). <u>Materials and Methods</u>: This study included 81 patients. Three knowledge-oriented items (recommended or not, screening frequency, age of onset) were assessed. Regarding screening tests two levels of knowledge were evaluated: i). crude knowledge (CK), i.e. knowledge that the test is recommended and ii). advanced knowledge (AK), i.e. correct response to all three knowledge-oriented items. Solely CK was evaluated for tests without proven screening value. Risk factors for lack of knowledge were assessed with multivariate logistic regression. A second questionnaire was administered 18 months after VABB to assess its impact on the performance of tests. <u>Results:</u> Concerning screening tests considerable lack of AK was noted (mammogram, 60.5%; Pap smear, 59.3%; fecal occult blood testing, 93.8%; sigmoidoscopy, 95.1%). Similarly lack of CK was documented regarding tests without proven screening value (breast self-examination, 92.6%; breast MRI, 60.5%; abdominal ultrasound, 71.6%; barium meal, 48.1%; urine analysis, 90.1%; chest X-Ray, 69.1%; electrocardiogram, 74.1%; cardiac ultrasound, 75.3%). Risk factors for lack of AK were: place of residence (mammogram), age (Pap smear), personal income (sigmoidoscopy); risk factors for lack of CK included number of offspring (breast MRI, chest X-Ray), BMI (abdominal ultrasound), marital status (urine analysis), current smoking status (electrocardiogram). VABB's only effect was improvement in mammogram rates. <u>Conclusions:</u> A considerable lack of knowledge concerning screening tests and misperceptions regarding those without proven value was documented.

Keywords: Cancer screening - mammogram - breast MRI - breast self-examination - pap smear - sigmoidoscopy

Introduction

Greece is a country where cancer screening is extremely problematic, according to data coming from the recent Delphi consensus study (Skroumpelos et al., 2013) as well as the studies issued by the Panhellenic Association for Continual Medical Research (PACMER) (Kamposioras et al., 2007; Mauri et al., 2009). Specifically concerning mammogram, the PACMER investigators reported a screening rate equal to 22.8% (Mauri et al., 2009) whereas the Hellas Health I Survey reported a rate equal to 53.8% adopting less strict criteria (i.e. mammogram within the past 3 years) in a predefined age group (50-69 years). Accordingly, at the level of Greek physicians, the recent Delphi study demonstrated a considerable lack of consensus among experts, especially regarding colorectal cancer (Skroumpelos et al., 2013).

It is worth mentioning that underscreening represents solely the bright side of the moon; at the dark side a local particularity emerges: physicians frequently recommend tests which are not useful for screening purposes, such as tumor markers (Vittoraki et al., 2007) or annual chest radiography (Kamposioras et al., 2006). Moreover, Greece is facing an important economic recession; economic crisis may further the underuse of screening tests, particularly those associated with higher costs (Myong et al., 2012).

Vacuum-Assisted Breast Biopsy (VABB) is a recently developed biopsy method, aiming to obtain tissue for histopathological diagnosis of non-palpable mammographic lesions. VABB is characterised by satisfactory underestimation of the lesions and can be performed under stereotactic or ultrasonographic guidance; an 11-Gauge (11G) needle is most commonly used for sampling of the suspicious lesion (Dershaw et al.,

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2003; Zografos et al., 2008). Our previous research work has shown that VABB is a multifaceted experience in a woman's life, considerably affecting the woman's health-related quality of life (Domeyer et al., 2010) and stress (Gounaris et al., 2007); its distinct features compared to other breast biopsy methods result in a distinct pattern of adherence to clinical recommendations for follow-up (Sergentanis et al., 2009).

Irrespectively to the biopsy method, benign breast biopsy may exert multipotent effects upon screening-related habits of patients. An increase in the adherence to mammogram has been documented (Zografos et al., 2010) whereas data concerning the effects upon Breast Self-Examination (BSE) remain contradictory (Janz et al., 1990; Zografos et al., 2010), as they may depend on the palpability of the lesion (Zografos et al., 2010) or the way the lesion of the patient was discovered (Janz et al., 1990).

The aim of this study is to: *i*) evaluate the level of knowledge about the recommended screening tests (mammogram, Pap smear, fecal occult blood testing, sigmoidoscopy) as well as about tests without proven screening value (BSE, breast Magnetic Resonance Imaging (MRI), abdominal ultrasound, barium meal, urine analysis, chest X-Ray, electrocardiogram, cardiac ultrasound) in a Breast Unit population undergoing benign VABB; *ii*) evaluate risk factors for lack of knowledge, making the distinction between necessary and unnecessary tests; and *iii*) examine whether benign VABB may modify the practice of all the tests above.

Materials and Methods

Patients

Exclusion criteria for this study were: previous breast cancer, severe comorbidity (psychiatric conditions, stroke, autoimmune diseases, cancer, severe coronary heart failure, i.e. NYHA stage III or IV). In addition patients diagnosed with precursor (atypical ductal hyperplasia, ADH and lobular neoplasia, LN) lesions, as well as carcinomas (ductal in situ, DCIS or invasive, IDC, lobular carcinomas) were excluded from the study, as the follow-up/treatment of these conditions, respectively, may represent significant deviation from the screening recommendations pertaining to the general population.

Of the 164 consecutive patients who came to our Breast Unit due to non-palpable mammographic lesions requiring VABB, only 81 were eligible for this study (Figure 1). The women were 33-80 years old.

Patients were informed (orally and in written) about the procedure, possibility of pain and complications by the surgeon performing VABB. Written signed informed consent was obtained from all patients. The study was approved by the Local Institutional Review Board.

VABB performance-local anesthesia

All patients presenting with a non-palpable mammographic lesion (microcalcifications, solid lesion or asymmetric density) BI-RADS 3 or 4 underwent VABB under stereotactic guidance (11G) on the Fisher's table (Mammotest, Fischer Imaging, Denver, CO, USA).

According to the results of a double-blind study (Zografos et al., 2008), a variable number of cores (24-96 cores) has been excised.

All procedures were performed by the same surgeon, in the same Unit, according to the recommended local anesthesia (Dershaw, 2003); in addition two specialist radiologists assisted at the procedures. The surgeon performing VABB was familiar with this method before the onset of this study, having already performed 350 VABB procedures. For local anesthesia, the two-step approach was adopted: 5 cm^3 1% lidocaine without epinephrine (superficial) and 10 cm^3 1% lidocaine with epinephrine (deep) were administered. The biopsy was performed according to a standard protocol to assure quality control. Compression bandages were applied so as to prevent hematoma.

Structure and administration of questionnaires

All patients were asked to complete the questionnaires, *i*) in the morning of the VABB procedure day (i.e. 1-2 hours prior to biopsy, designated as baseline measurement) and *ii*) 18 months after VABB.

At baseline the following were asked for each test (mammogram, BSE, breast MRI, Pap smear, fecal occult blood testing, sigmoidoscopy, abdominal ultrasound, barium meal, urine analysis, chest X-Ray, electrocardiogram, cardiac ultrasound): "*Is this test performed as a screening test?*" (yes/no), "*If yes, please indicate: i) the age of screening onset for the test and ii) how often the test should be performed*" (open items). The above were designated as *knowledge-oriented items*.

At both time points the following were asked for each test: "*Do you regularly perform the test?*" (yes/no) and "*How often do you perform the test?*" (open item); the above were designated as *practice-oriented items*.

At the baseline assessment the following information concerning possible risk factors was obtained: *i*) anthropometric features (height, weight, from which Body Mass Index (BMI) was calculated); *ii*) sociodemographic parameters i.e. age, place of residence (urban or rural),
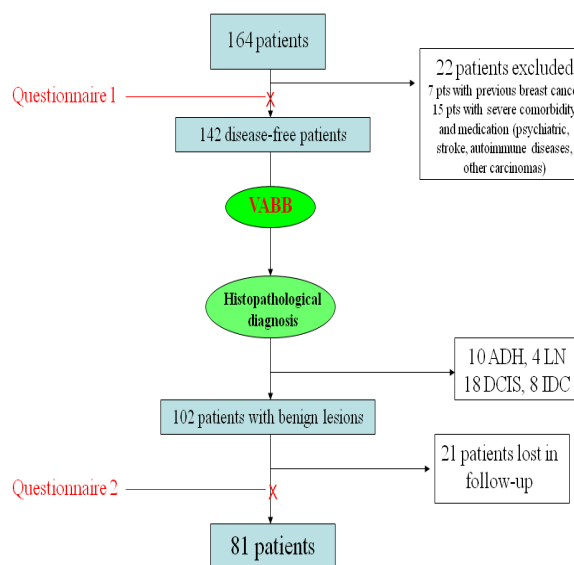

Figure 1. Flow Chart Presenting the Inclusion of Patients

education (1=primary education, 2=secondary education, 3=technological educational institute, 4=university, 5=postgraduate university education), professional risk (0=low risk, i.e. permanent employees and housewives, 1=high risk, i.e. non-permanent job, for instance in the private sector or self-employed), marital status (married/living with partner, single, widowed, divorced), number of offspring (male and female separately), personal income; *iii*) lifestyle habits (current smoking); *iv*) breast-related parameters (mastalgia, presence of fibrocystic disease, breast cancer history in a first-degree relative, duration of breastfeeding), *v*) reproductive history (menopausal status, age at menarche, age at first full-term pregnancy, spontaneous abortions, miscarriages, number of prior caesarian sections, oral contraceptive/HRT (hormone replacement therapy) ever-use; *vi*) VABB-related features [referral, type of lesion (microcalcifications, solid lesion, asymmetric density), BI-RADS classification]; and *vii*) seasonality (biopsy month).

Evaluation of responses and statistical analysis

Concerning the knowledge-oriented items the patients' responses were evaluated according to the 2010-2011 Recommendations of the U.S. Preventive Services Task Force (Agency for Healthcare Research and Quality, 2010-2011). The distinction between two levels of knowledge was made: *i*) crude knowledge (CK), i.e. correct response to the item "*Is this test performed as a screening test?*"(yes/no) and *ii*) advanced knowledge (AK), i.e. correct response to all three knowledge-oriented items. In case a knowledge-oriented item was left blank the response was separately reported, as it most probably denotes lack of knowledge. Evidently, solely CK pertained to tests without screening value whereas the evaluation concerning recommended screening tests essentially encompassed AK and CK (Figure 2). Descriptive statistics were calculated for both levels of knowledge.

The associations between possible risk factors and both levels of knowledge were assessed first through univariate analysis; the predictors proven significant in the univariate analysis were included in the multivariate
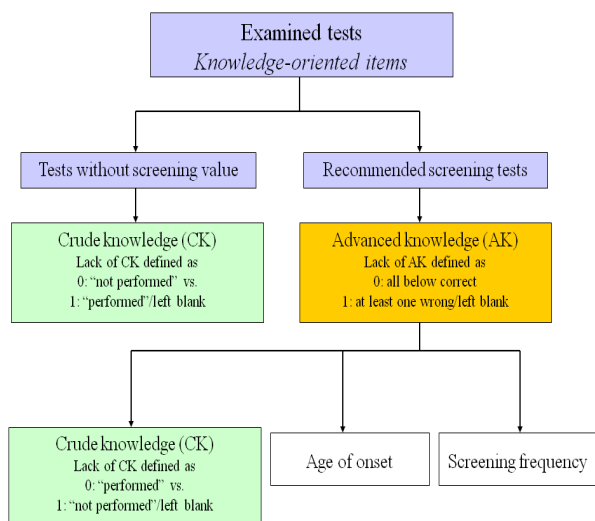
models. Multivariate logistic regression was performed with the lack of knowledge (CK or AK) set as the dependent variables so as to identify risk factors for lack of knowledge; backward selection of variables was performed.

Similarly to the evaluation of knowledge, the assessment of the practice-oriented items was performed according to the 2010-2011 Recommendations of the U.S. Preventive Services Task Force (Agency for Healthcare Research and Quality, 2010-2011). To designate practice as "wrong", the following scenarios were possible: *i*)
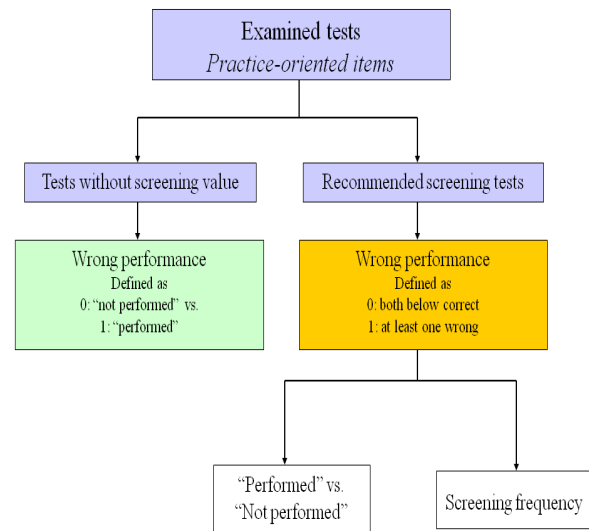

Figure 3. Flow Chart Explaining the Analysis of Practice-oriented Items

Table 1. Description of the Study Sample

Categorical variables		No. %
Sociodemographic parameters and lifestyle habits		
Place of residence	Urban	57 (70.4)
	Rural	24 (29.6)
Education	Primary education	16 (19.8)
	Secondary education	33 (40.7)
	Technological educational institute	9 (11.1)
	University	17 (21.0)
	Postgraduate university education	6 (7.4)
Marital status	Married/living with partner	63 (77.8)
	Single/Divorced/Widowed	18 (22.2)
Current smoking	Yes	21 (25.9)
	No	60 (74.1)
Breast-related parameters		
Mastalgia	Yes	22 (27.2)
	No	59 (72.8)
Breast cancer history in a first-degree relative		
	Yes	6 (7.4)
	No	75 (92.6)
Reproductive history		
Menopausal status	Premenopausal	34 (42.0)
	Postmenopausal	47 (58.0)
VABB-related features		
BI-RADS classification	BI-RADS 3	30 (37.0)
	BI-RADS 4	51 (63.0)
Hematoma	Yes	4 (4.9)
	No	77 (95.1)
Continuous variables	Mean±SD (median)	
	Age (years)	51.1±8.6 (50.0)
	BMI (kg/m^2)	24.8±3.9 (23.9)
	Personal income (euro)	820±708 (735)
	Number of offspring	1.8±1.1 (2.0)
	Volume of tissue excised (cc)	4.0±3.1 (3.0)

Figure 2. Flow Chart Explaining the Analysis of Knowledge-oriented Items

Table 2. Knowledge about the Tests Evaluation at Baseline.

Test		Recommended for screening Freq (%)	Age of onset Freq (%)	Screening frequency Freq (%)	Lack of CK Freq (%)	Lack of AK Freq (%)
Mammogram	Definition of "correct"	Yes	40 years	Every 1-2 years	4/81 (4.9)	49/81 (60.5)
	Correct	77/81 (95.1)	39/77 (50.6)	62/77 (80.5)		
	Wrong	1/81 (1.2)	34/77 (44.2)	6/77 (7.8)		
	Left blank	3/81 (3.7)	4/77 (5.2)	9/77 (11.7)		
Breast self-examination	Definition of "correct"	No			75/81 (92.6)	N/A
	Correct	6/81 (7.4)	N/A*	N/A		
	Wrong	69/81 (85.2)				
	Left blank	6/81 (7.4)				
Breast MRI	Definition of "correct"	No			49/81 (60.5)	N/A
	Correct	32/81 (39.5)	N/A	N/A		
	Wrong	31/81 (38.3)				
	Left blank	18/81 (22.2)				
Pap smear	Definition of "correct"	Yes	≤21 years	Every 1-3 years	3/81 (3.7)	48/81 (59.3)
	Correct	78/81 (96.3)	36/78 (46.1)	70/78 (89.7)		
	Wrong	0/101 (0.0)	41/78 (52.6)	4/78 (5.1)		
	Left blank	3/81 (3.7)	1/78 (1.3)	4/78 (5.1)		
Fecal occult blood testing	Definition of "correct"	Yes	50 years	Every 1 year	41/81 (50.6)	76/81 (93.8)
	Correct	40/81 (49.4)	15/40 (37.5)	14/40 (35.0)		
	Wrong	32/81 (39.5)	18/40 (45.0)	19/40 (47.5)		
	Left blank	9/81 (11.1)	7/40 (17.5)	7/40 (17.5)		
Sigmoidoscopy	Definition of "correct"	Yes	50 years	Every 5 years	40/81 (49.4)	77/81 (95.1)
	Correct	41/81 (50.6)	17/41 (41.5)	10/41 (24.4)		
	Wrong	28/81 (34.6)	21/41 (51.2)	22/41 (53.7)		
	Left blank	12/81 (14.8)	3/41 (7.3)	9/41 (21.9)		
Abdominal ultrasound	Definition of "correct"	No			58/81 (71.6)	N/A
	Correct	23/81 (28.4)	N/A	N/A		
	Wrong	43/81 (53.1)				
	Left blank	15/81 (18.5)				
Barium meal	Definition of "correct"	No			39/81 (48.1)	N/A
	Correct	42/81 (51.8)	N/A	N/A		
	Wrong	21/81 (25.9)				
	Left blank	18/81 (22.2)				
Urine analysis	Definition of "correct"	No			73/81 (90.1)	N/A
	Correct	8/81 (9.9)	N/A	N/A		
	Wrong	66/81 (81.5)				
	Left blank	7/81 (8.6)				
Chest X-Ray	Definition of "correct"	No			56/81 (69.1)	N/A
	Correct	25/81 (30.9)	N/A	N/A		
	Wrong	41/81 (50.6)				
	Left blank	15/81 (18.5)				
Electrocardiogram	Definition of "correct"	No			60/81 (74.1)	N/A
	Correct	21/81 (25.9)	N/A	N/A		
	Wrong	48/81 (59.3)				
	Left blank	12/81 (14.8)				
Cardiac ultrasound	Definition of "correct"	No			61/81 (75.3)	N/A
	Correct	20/81 (24.7)	N/A	N/A		
	Wrong	50/81 (61.7)				
	Left blank	11/81 (13.6)				

*N/A: Not Applicable

[A bar chart is overlaid on the table. Visible axis values: 100.0, 75.0, 50.0, 25.0, 0; segment labels: 6.3, 10.1, 20.3, 25.0, 56.3, 46.8, 54.2, 31.3, 50.0, 38.0, 31.3, 23.7, 30.0; category labels: "Newly diagnosed without treatment", "Newly diagnosed with treatment", "Persistence or recurrence", "Remission", "None", "Newly diagnosed without treatment", "Chemotherapy".]

Regular performance of the test without proven screening value or *ii*) No performance or performance at wrong intervals of a screening test. As a result, a binary (wrong/correct) variable was generated (Figure 3).

Regarding the effect of VABB, the difference between the practice before vs after VABB was assessed with the exact McNemar test. Breast MRI was not included in the analysis concerning VABB as women may have been prescribed an MRI and subsequently performed that in the context of follow-up. In addition sigmoidoscopy was not included in the analysis concerning VABB as the interval after VABB in our study (18 months) was much shorter than the recommended interval (5 years).

The statistical analysis was performed using STATA 8.0 statistical software (Stata Corporation, College Station, TX, USA).

Results

The majority of the study sample resided in urban settings, while 6 out of 10 patients had completed primary or secondary education and 3 quarters of our study sample did not smoke (Table 1). Baseline values of CK, AK as well as all three constituents of AK (recommended for screening, age of onset, screening frequency) were thoroughly evaluated (Table 2). There was a high rate (6 out of 10) of responders with lack of AK regarding the mammogram and a very high rate (9 out of 10) of responders with lack of CK concerning the BSE. Also, 60.5% showed lack of CK for breast MRI

Table 3. Risk Factors for Lack of Knowledge about all the Examined Tests. Results Derived from Multivariate Logistic Regression Analysis

Test	Category or increment		OR (95% CI)	p
Risk factors for lack of AK concerning recommended screening tests				
Mammogram:	Living outside Athens	Outside Athens vs. Athens	0.22 (0.07-0.63)	0.005
Pap smear: Age	1 year increase		1.07 (1.00-1.13)	0.038
Sigmoidoscopy:	Personal income	100 euro increase	0.83 (0.71-0.97)	0.018
Risk factor for lack of CK concerning tests without proven screening value				
Breast MRI:	Number of offspring	1 child increase	0.56 (0.32-1.01)	0.052
Abdominal ultrasound:	BMI	1 Kg/m^2 increase	0.82 (0.68-1.00)	0.047
Urine analysis:	Marital status	Married vs.single/widowed/divorced	4.21 (0.94-18.95)	0.061
Chest X-Ray:	Number of offspring	1 child increase	0.51 (0.28-0.95)	0.035
Electrocardiogram:	Current smoking status	Smoker vs non-smoker	0.34 (0.12-0.99)	0.049

Table 4. Wrong Performance of Tests Before and After VABB

Test	Wrong performance		p*
	Before VABB Freq (%)	After VABB Freq (%)	
Mammogram[a]	22/76 (28.9)	12/76 (15.8)	0.021
Breast self-examination	48/81 (59.3)	52/81 (64.2)	0.219
Pap smear	26/81 (32.1)	30/81 (37.0)	0.289
Fecal occult blood testing[b]	41/42 (97.6)	41/42 (97.6)	>0.999
Abdominal ultrasound	18/81 (22.2)	21/81 (25.9)	0.508
Barium meal	0/81 (0.0)	0/81 (0.0)	>0.999
Urine analysis	55/81 (67.9)	52/81 (64.2)	0.375
Chest X-Ray	12/81 (14.8)	14/81 (17.3)	0.723
Electrocardiogram	20/81 (24.7)	16/81 (19.8)	0.289
Cardiac ultrasound	14/81 (17.3)	12/81 (14.8)	0.500

*p-values were derived from exact McNemar test; [a]Subanalysis performed on women aged ≥40 years; [b] Subanalysis performed on women aged ≥50 years

and approximately 5 out of 10 responders showed lack of CK for barium meal, whereas the rates for abdominal ultrasound, urine analysis, chest X-Ray, electrocardiogram and cardiac ultrasound were considerably higher. With regard to Table 2, it is worth noting that the denominator in the second ("Recommended for screening"), fifth ("Lack of CK") and sixth ("Lack of AK") column refers to the total of the sample; on the contrary the denominators in the third ("Age of onset") and fourth ("Screening frequency") columns refer to patients answering correctly the "Recommended for screening" item.

The risk factors for lack of knowledge about all the examined tests were analyzed (Table 3). Living in Athens was associated with lack of AK for mammogram, increasing age was associated with lack of AK for Pap Smear, while decreasing personal income was associated with lack of AK for sigmoidoscopy. Decreasing number of children was associated with lack of CK for Breast MRI and chest X-Ray, decreasing BMI was associated with lack of CK for abdominal ultrasound, being married was associated with lack of CK for urine analysis and being non-smoker was associated with lack of CK for electrocardiogram. No significant predictors were found concerning mammogram (CK), BSE (CK), Pap smear (CK), fecal occult blood test (CK and AK), sigmoidoscopy (CK) and cardiac ultrasound (CK).

The rates of wrong performance of tests before and after VABB were studied (Table 4). No significant differences were documented with the exception of a statistically significant decrease in the wrong performance of mammogram (p=0.021).

Discussion

This study demonstrates a considerable lack of knowledge regarding breast-related tests in the population of the Breast Unit. Given that these women represent a rather selected population being in contact with the tertiary health services of our Unit, the demonstrated level of poor knowledge may seem rather surprising. Specifically, although women have the rather vague knowledge about the need for mammogram (CK equal to 95%), solely a minority of them (AK equal to 40%) are exactly aware of the recommended screening age and intervals; this seems in accordance with the data provided by the nation-wide Hellas Health I Survey (Dimitrakaki et al., 2009) as well as the studies issued by PACMER (Mauri et al., 2009). Importantly, our study denotes a framework of knowledge considerably poorer than that achieved in Northern European countries, where mammography rates equal to almost 80% have been reported (Hakama et al., 2008). Furthermore, the major economic crisis from which Greece is suffering may aggravate this lack of knowledge. This may be the result of the recession of preventive strategies and corresponding public awareness because of the high costs implicated, which are partially due to the fragmented and cost-ineffective Greek primary care system (Oikonomou and Tountas, 2011).

On the other hand, our study demonstrates a considerable misperception of the need for BSE, as 85% of women believe that BSE is part of the recommended screening strategies (in other words lack of CK equal to 93%). Given that BSE does not offer any benefit in terms of early diagnosis and rather leads to unnecessary benign breast biopsies (Kösters et al., 2003), this result may have significant public health implications. Even more surprisingly, 38% of women reported that breast MRI is a screening test which should be routinely performed, whereas 22% of women did not express any opinion, leaving the item blank. At any case, both results dictate that the education of patients aiming to minimize unnecessary acts (i.e., BSE) and costly tests (i.e., breast MRI) is mandatory; to our knowledge this is the first study reporting such a degree of misperception regarding breast MRI.

With respect to Pap smear, once again, the level of AK was extremely low (41%); once again, the facts in Greece seem far from those reported in Nordic countries, where population coverage reaches 100% (Giorgi and Ronco, 2013). By far, however, the most disappointing

conditions demonstrated in our study are those pertaining to colorectal cancer. AK for fecal occult blood testing and sigmoidoscopy were 6% and 5% respectively; this is in accordance with other Greek studies (Kamposioras et al., 2007; Dimitrakaki et al., 2009). At the other end of the spectrum considerable misperception overestimating the need for tests without any proven screening value were documented; the levels of CK were particularly low in the case of urine analysis (10%), cardiac ultrasound (25%), electrocardiogram (26%), abdominal ultrasound (28%) and chest X-Ray (31%). This set of findings largely surpasses and extends the isolated observation by the PACMER investigators according to whom unnecessary chest X-Ray is prevalent in Greece (Kamposioras et al., 2006).

Concerning risk factors for lack of knowledge about recommended screening tests, a variety of associations seem worth commenting. Increasing age was associated with poorer knowledge about Pap smear. This finding may merit comparative evaluation with the nation-wide Hellas I survey, which reported increased likelihood of getting a Pap smear in a specific age group (30-49 vs. 21-29 years), but not in the age 50-69 subgroup (again vs. 21-29 years). Given that the median age in our sample is equal to 50, our finding most probably reflects the relative disadvantage of the 50-69 group described in the Hellas I study. With respect to colorectal cancer, our study confirms the well established link between low income and underscreening (Bronner et al., 2013) but essentially extends it at the level of knowledge. On the other hand, the favourable role of living outside Athens in terms of knowledge about mammogram rather points to a secondary association; women living outside Athens as a rule represent well-informed, self-selected patients which opt for examination in a tertiary Unit in Athens, such as ours.

Regarding tests without proven screening value, family (as reflected upon number of offspring and marital status) seems to play a multivalent role. Specifically, the protective association implicating chest X-Ray and breast MRI may be inscribed into the well established context depicting married women as better performers of screening (Martin-López et al., 2013). On the other hand the aggravating association pointing to marriage as a risk factor for misconception of urine analysis may reflect a different pattern of sexual activity, the latter being a risk factor for urinary tract infections (Moore et al., 2008); in other words married, sexually active women, may be prescribed urine analyses more frequently and thus seem to have converted this fact to a misperception. Higher BMI and smoking appeared as protective factors for the allocation of screening role to abdominal ultrasound and ECG respectively; it seems more rational to interpret these factors as markers of detachment from screening-related tests in general as demonstrated in the case of obese women (Sangrajrang et al, 2012; Kendall et al, 2013).

Apart from the assessment of knowledge this study also evaluates the practice (performance) of tests. Misperceptions were reflected upon misuse at a certain degree. However, regarding recommended screening tests it is worth commenting that practice rates tended to be more favourable (higher) than AK rates; this may be partly due to the fact that AK encompasses theoretical knowledge about the age of screening onset whereas practice essentially implies following the age-specific physician's recommendations. Regarding tests without proven screening value once again practice rates were more favourable (lower) than CK rates; this may reflect the fact that misperceptions are not actually translated into misuse as inhibiting factors such as fear (Levy et al., 2007), lack of symptoms or interest (Levy et al., 2007), hesitation or reluctance may interfere. Importantly, VABB was not capable of modifying the practice patterns with the exception of mammogram, where improvement in performance was documented; this is in accordance with our previous study regarding the effect of benign breast biopsy in general (Zografos et al., 2010).

This study bears several limitations that should be acknowledged; the study has been performed on a well defined, but selected population i.e. women undergoing VABB. Therefore the results may not be extrapolated to the general population with certainty. In addition the relatively small sample size should be acknowledged but was due to the strict selection criteria of the study.

In conclusion, this study demonstrates considerable lack of knowledge concerning screening tests as well as misperceptions allocating screening role to tests deprived from screening properties. Given that VABB did not modify the main set of performance, the education of women seems mandatory so that the contact with a Breast Unit be not a lost opportunity in terms of public health.

References

Agency for Healthcare Research and Quality (2010-2011). Guide to Clinical Preventive Services, 2010-2011. Recommendations of the U.S. Preventive Services Task Force.

Bronner K, Mesters I, Weiss-Meilik A, et al (2013). Determinants of adherence to screening by colonoscopy in individuals with a family history of colorectal cancer. *Patient Educ Couns*, [Epub ahead of print].

Dershaw DD (2003). Imaging-guided Interventional Breast Techniques. Springer.

Dimitrakaki C, Boulamatsis D, Mariolis A, et al (2009). Use of cancer screening services in Greece and associated social factors: results from the nation-wide Hellas Health I survey. *Eur J Cancer Prev*, **18**, 248-57.

Domeyer PJ, Sergentanis TN, Zagouri F, Zografos GC (2010). Health-related quality of life in vacuum-assisted breast biopsy: short-term effects, long-term effects and predictors. *Health Qual Life Outcomes*, **27**, 11.

Giorgi Rossi P, Ronco G (2013). The present and future of cervical cancer screening programmes in Europe. *Curr Pharm Des*, **19**, 1490-7.

Gounaris A, Zagouri F, Sergentanis TN, et al (2007). Vacuum-assisted breast biopsy: insight into stress-induced endocrine events. *In Vivo*, **21**, 1081-4.

Hakama M, Coleman MP, Alexe DM, Auvinen A (2008). Cancer screening: evidence and practice in Europe 2008. *Eur J Cancer*, **44**, 1404-13.

Janz NK, Becker MH, Haefner DP, Rutt WM, Weissfeld LA (1990). Determinants of breast self-examination after a benign biopsy. *Am J Prev Med*, **6**, 84-92.

Kamposioras K, Casazza G, Mauri D, et al (2006). Screening chest radiography: results from a Greek cross-sectional

survey. *BMC Public Health*, **6**, 113.

Kamposioras K, Mauri D, Alevizaki P, et al (2008). Cancer screening in Greece. Guideline awareness and prescription behavior among Hellenic physicians. *Eur J Intern Med*, **19**, 452-60.

Kamposioras K, Mauri D, Golfinopoulos V, et al (2007). Colorectal cancer screening coverage in Greece. PACMeR 02.01 study collaboration. *Int J Colorectal Dis*, **22**, 475-81.

Kendall KA, Lee E, Zuckerman IH, et al (2013). Obesity status and colorectal cancer screening in the United States. *J Obes,* [Epub ahead of print].

Kösters JP, Gøtzsche PC (2003). Regular self-examination or clinical examination for early detection of breast cancer. *Cochrane Database Syst Rev*, **2**, 3373.

Levy BT, Nordin T, Sinift S, Rosenbaum M, James PA (2007). Why hasn't this patient been screened for colon cancer? An Iowa Research Network study. *J Am Board Fam Med*, **20**, 458-68.

Martin-López R, Jiménez-García R, Lopez-de-Andres A, et al (2013). Inequalities in uptake of breast cancer screening in Spain: analysis of a cross-sectional national survey. *Public Health*, [Epub ahead of print].

Mauri D, Valachis A, Polyzos NP, et al (2009). Screening practice and misplaced priorities. *Clin Transl Oncol*, **11**, 228-36.

Moore EE, Hawes SE, Scholes D, et al (2008). Sexual intercourse and risk of symptomatic urinary tract infection in post-menopausal women. *J Gen Intern Med*, **23**, 595-9.

Myong JP, Kim HR (2012). Impacts of household income and economic recession on participation in colorectal cancer screening in Korea. *Asian Pac J Cancer Prev*, **13**, 1857-62.

Oikonomou N, Tountas Y (2011). The Greek economic crisis: a primary health-care perspective. *Lancet*, **377**, 28-9.

Sangrajrang S, Chokvanitphong V, Sumetchotimaytha W, Khuhaprema T (2012). Evaluation of health status of a population underwent routine medical check up at the high risk screening clinic in National Cancer Institute. *Asian Pac J Cancer Prev*, **13**, 5759-62.

Sergentanis TN, Zagouri F, Domeyer P, et al (2009). Biopsy method: a major predictor of adherence after benign breast biopsy? *AJR Am J Roentgenol*, **193**, 452-7.

Skroumpelos A, Zavras D, Pavi E, Kyriopoulos J (2013). Recommending organized screening programs for adults in Greece: a Delphi consensus study. *Health Policy*, **109**, 38-45.

Vittoraki A, Alexiou G, Karakatsanis A, et al (2007). Tumour marker prescriptions for cancer screening in the Hellenic primary care. *Eur J Cancer Care (Engl)*, **16**, 86-9.

Xilomenos A, Mauri D, Kamposioras K, et al (2006). Panhellenic Association for Continual Medical Research (PACMeR). Colorectal cancer screening awareness among physicians in Greece. *BMC Gastroenterol*, **6**, 18.

Zografos GC, Zagouri F, Sergentanis TN, et al (2008). Minimizing underestimation rate of microcalcifications excised via vacuum-assisted breast biopsy: a blind study. *Breast Cancer Res Treat*, **109**, 397-402.

Zografos GC, Zagouri F, Sergentanis TN, et al (2008). Pain during vacuum-assisted breast biopsy: are there any predictors? *Breast*, **17**, 592-5.

Zografos GC, Sergentanis TN, Zagouri F, et al (2010). Breast self-examination and adherence to mammographic follow-up: an intriguing diptych after benign breast biopsy. *Eur J Cancer Prev*, **19**, 71-2.