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Economic Evaluation

Breast Cancer Screening in Georgia: Choosing the Most Optimal and Cost-Effective Strategy

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ABSTRACT

Objectives: To define the optimal and cost-effective breast cancer screening strategy for Georgia.

Methods: We used the Microsimulation Screening Analysis-Breast (MISCAN-Breast) model that has been adapted to the Georgian situation to evaluate 736 mammography screening strategies varied by interval (biennial and triennial), starting ages (40-60 years), stopping ages (64-84 years), and screening modality (with and without clinical breast examination [CBE]). Quality-adjusted life-years (QALYs) and additional cost (healthcare perspective) compared with no screening per 1000 women were calculated with 3% discount. Major uncertainties (eg, costs) are addressed as sensitivity analyses.

Results: Strategies using a combination of mammography and CBE yielded in substantially higher costs with minimal differences in outcomes compared with mammography-only strategies. The current screening strategy, biennial mammography screening from the age of 40 until 70 years with CBE, is close to the frontier line but requires high additional cost given the QALY gains (€16 218/QALY), well above the willingness-to-pay threshold of €12 720. The optimal strategy in Georgia would be triennial mammography-only screening from age 45 to 66 years with an incremental cost-effectiveness ratio of €12 507.

Conclusions: Biennial screening strategies are resource-intensive strategies and may not be feasible for Georgia. By switching to triennial mammography-only strategy from the age of 45 until 66 years, it is possible to offer screening to more eligible women while still gaining substantial screening benefits. This is to address capacity issues which is a common barrier for many Eastern European countries.

Keywords: breast neoplasms, early detection of cancer, Georgia, mammography, quality-adjusted life-years.

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Introduction

Breast cancer is one of the most important causes of cancer mortality in Georgia. In 2020, 910 women died of breast cancer (43.6 deaths per 100 000).[1] To address this public health concern, a national breast cancer screening program has been implemented since 2008. Currently, screening is offered to women aged between 40 and 70 years old every 2 years using a combination of mammography and clinical breast examination (CBE).[2] Recruitment is organized through self-enrollment and referrals from physicians. Because of implementation barriers, including capacity, resource availability, and lack of public awareness of the program, the screening participation is only 10%.[3]

Efforts to optimize the screening program are ongoing. The EUTOPIA-EAST (Towards Improved Screening for Breast, Cervical and Colorectal Cancer in Eastern Europe: Equitable, Actionable, Sustainable, and Trustworthy) project aims to improve the implementation of breast, cervical, and colorectal cancer screening programs in Eastern European countries. Georgia is the country in which its breast cancer screening program is being optimized within the project.

Before defining actions to improve the implementation, it is crucial to understand what the optimal breast cancer screening strategy is in Georgia. Previous screening trials and cost-effectiveness evaluations have been performed in settings which are different in terms of demographic characteristics, life expectancy, breast cancer epidemiology, survival, screening tests characteristics, costs, and resource availability.[4-6] Therefore, it is possible that the optimal breast cancer screening strategy is different for Georgia than for most Western European countries.

Performing a cost-effectiveness evaluation for an Eastern European country such as Georgia will increase evidence on cost-effectiveness of different breast cancer screening strategies that take into account more contextualized costs and resource availability. Such analyses are needed for future guidelines and recommendations, especially in regard of implementation of breast cancer screening in Eastern Europe.[7] Although deciding an optimal strategy will require considerations of other factors not

included in such analysis and countries are not obliged to exactly follow modeling results, performing such analysis will provide evidence for informed decision making in screening implementation. Hence, this study aims to investigate the optimal breast cancer screening strategy for Georgia by performing a cost-effectiveness evaluation through simulations of an extensive number of different screening strategies.

Methods

Model, Parameters, and Assumptions

To evaluate the impact of different screening strategies, we used the Microsimulation Screening Analysis-Breast (MISCAN-Breast) model. This extensively validated model is a semi-Markov and stochastic microsimulation model that simulates women's individual life histories and natural history of breast cancer. The MISCAN model is programmed in Delphi. Further model information and comparisons of model predictions with real life data are available in previous published studies.[8,9]

Because this is a microsimulation model, simulations were performed individually instead of as proportions of cohorts. This allows the individual probabilities of progressing to the next event to be dependent on the previous event(s). For a subset of simulated women, breast cancer is initiated with ductal carcinoma in situ, followed by T1A, T1B, T1C, and T2+, respectively. Tumors can be clinically detected through symptoms, screen detected, or progress to the next stage. The structure of the model is presented in the Supplementary Material (see Appendix Fig. 1 of Appendix A in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2023.09.002).

For this analysis, we adapted the model to the Georgian situation. As a starting point we used the Slovenian MISCAN-Breast Model that was developed in the previous EU-TOPIA project as an exemplary model for the Eastern European region.[10] We first inputted Georgian female population size by age in 2018. Because of similar life expectancy with Georgia (78.4 years for females),[11] we inputted the life table of Bulgaria into the model. The Bulgarian life table was used because the Georgian life table is not listed in Human Mortality Database.[12]

We continued with calibrating 15 parameters, which include 5 parameters on age-specific onset hazard, 3 parameters on clinical detection probabilities, 5 parameters on stage-specific screening sensitivities, and 2 parameters on cancer survival. Except for cancer survival, all parameters were calibrated using the Nelder-Mead method using age-specific breast cancer incidence in Georgia between 2015 and 2019 as the calibration target. Cancer survival was calibrated manually to fit the age-specific breast cancer mortality in Georgia between 2015 and 2019.[13] The fit of the model predictions with the observed data from Georgia is presented in the supplementary material (see Appendix Figs. 2-4 of Appendix B in Supplemental Materials found at https://doi.org/10.1016/j.vhri.2023.09.002).

The already calibrated model was used to simulate 10 million women aged 40 years old who were born in the same year. They were followed up until deaths or until reaching the age of 100 years old.

An extensive set of screening strategies with varying starting ages (40-60 years), stopping ages (64-84 years), intervals (biennial and triennial), and screening modality (with and without CBE) were also simulated. The lowest simulated starting age is 40 years despite not being recommended by the European Commission Initiatives on Breast Cancer (ECIBC). This is because current screening in Georgia starts at the age of 40 years. For stopping ages, ECIBC's recommended stopping age of 74 years was chosen with 10 years lower and higher variations. Biennial and triennial intervals were chosen based on the recommendation of ECIBC.[14] Finally, the CBE and no CBE strategies were chosen to decide whether or not to keep CBE in the screening program. In total, there were 736 different simulated strategies. Participation was set to be 100% to show the full potential screening effects and to make sure the outcomes comparability between simulated strategies.

One of the most essential assumptions on cost-effectiveness analysis of screening is the test sensitivities of different diagnostic modalities. In this analysis, mammography with and without CBE are 2 different evaluated diagnostic modalities. We applied test sensitivities estimates yielded from the calibration for strategies using the currently implemented diagnostic modality, mammography in combination with CBE. This is because the calibration against breast cancer incidence as the calibration target can provide estimates of test sensitivities of the currently used diagnostic modality. For mammography-only strategies, we reduced the calibrated sensitivities by 4.4% based on a study by Oestreicher et al[15] to take into account the reduction of sensitivities attributed to the removal of CBE as a primary screening modality.

Cost-Effectiveness Analysis

For all strategies, the number of invitations, tests, ductal carcinoma in situ cases, invasive breast cancer cases, breast cancer deaths, false positives, and life-years were calculated. Overdiagnoses, which are defined as diagnoses of cancer that would never be diagnosed in the absence of screening, were also estimated.

We used the healthcare payer perspective and included only direct screening and medical costs. To obtain costs and utility values attributed to screening, treatment, and palliative care in Georgia, we started with a literature search. From this literature search, we assigned a utility value of 0.858 for simulated individuals with no breast cancer based on a previous published study on the general population EQ-5D-5L female reference values.[16] Screening participation was given 0.006 utility reduction for the duration of 1 week.[17] We also applied utility reduction of 0.105 with 5 week duration for positive screening test.[17] For treatment, we assigned a set of utility losses values that was previously used in a similar analysis in The Netherlands (see Table 1[8,16-21]).[8]

Because of the unavailability of costs information that reflect the Georgian situation, in 2021, co-authors who are based in Georgia actively asked clinics and oncology centers to obtain screening, treatment, and palliative care costs. In case the obtained costs were given in price range, the average between the highest and the lowest price range is used in this analysis. Aggregated and stage-specific treatment costs were calculated based on a previous Dutch study using the Georgian unit costs.[18] Costs were converted from Georgian Lari (GEL) to Euro (€) with 2021 currency exchange of 3.5 GEL per 1€. Furthermore, because there was a substantial inflation of 9.6% in Georgia by the end of 2021, we corrected the costs for inflation in 2021.[22]

An annual 3% discount was applied to both cost and quality-adjusted life-years (QALYs) based on a literature recommendation.[23] Total cost and QALYs of each strategy were respectively subtracted with total cost and QALYs in the no screening scenario to obtain the additional cost and QALYs gained compared with no screening.

After additional cost and gained QALYs for each simulated strategy were calculated, we performed an economic evaluation of healthcare interventions using the efficiency frontier method.[24]

Table 1. Utility losses, durations, and costs attributed to screening, diagnostics, and treatment of breast cancer in Georgia. Costs were corrected for inflation.

Items	Utility losses*	Durations	Costs (€)	Costs source
Screening and Diagnostics				Clinics and oncology centers in Georgia[19-21]
Clinical breast examination	n/a	n/a	30.5 (24-37)	
Mammography	0.006[17]	1 week[17]	41.0 (27-55)	
Biopsy	0.105[†]	5 weeks[†]	59.0 (52-66)	
Ultrasound	0.105[†]	5 weeks[†]	22.5 (20-25)	
Per unit treatment[‡]				Clinics and oncology centers in Georgia[19-21]
Surgery	n/a	n/a	861	
Radiotherapy	n/a	n/a	2708	
Chemotherapy	n/a	n/a	1957	Dutch prices adjusted by differences in surgery cost between Georgia and The Netherlands
Hormone therapy	n/a	n/a	1410	
Aggregated treatment				Calculated based on previous Dutch costs analysis using Georgian per unit treatment prices[18]
Treatment DCIS	0.1[8]	2 years[8]	2434	
Treatment stage T1aN-			2797	
Treatment stage T1bN-	0.1[8]	2 years[8]	3250	
Treatment stage T1cN-			4213	
Treatment stage T1bN+	0.25[8]	2 years[8]	4736	
Treatment stage T1cN+			4693	
Treatment stage T2+N-			4034	
Treatment stage T2+N+			3970	
Palliative care	0.4[8]	From diagnosis to death[8]	1816	Clinics and oncology centers in Georgia[19-21]

DCIS indicates ductal carcinoma in situ; n/a, not applicable.
*Each simulated individual with no breast cancer was given the utility value of 0.858.[16]
[†]Positive screening tests were given utility losses of 0.105 for 5 weeks.[17]
[‡]Utility losses and durations for treatment are given in the aggregated treatment section.

We plotted the additional cost in x-axis and QALY gains in y-axis for each simulated strategy. Then, a line was drawn linking the plotted strategies in which QALY gains were not dominated by other strategies at different levels of cost. This line is called efficiency frontier line. Strategies that fell on this line are considered efficient given the amount of cost. Then, the efficient strategies were ranked by additional cost compared with no screening per 1000 women from lowest to highest.

Incremental cost-effectiveness ratios were calculated for strategies on the efficiency frontier by dividing the costs difference by the QALYs difference between a strategy and its preceding strategy in the ranking.[25] The optimal strategy was defined using 3 times gross domestic product per capita of Georgia (€12 720) as the willingness-to-pay (WTP) threshold.[22,26]

Sensitivity Analyses

In sensitivity analyses we reduced and increased the test sensitivity, all costs, all utility losses, and referral rate by 10%. We also applied the Slovenian (better) survival values and a 5% annual discount rate. Finally, we set the mammography price to be lower (€27) and higher (€55) based on the cheapest or the most expensive mammography price obtained from different clinics or oncology centers. In total we tested 12 alternative assumptions as sensitivity analyses.

Results

Out of all 736 simulated strategies, there are 16 strategies on the efficiency frontier (Table 2). Those strategies are predicted to gain the most QALYs given the level of additional cost required. The currently implemented strategy is not among strategies on the efficiency frontier.

The benefits of screening are higher among more intensive strategies, which have wider ranges of eligible screening ages and shorter interval. However, these strategies are also estimated to be more expensive and have higher number of overdiagnosis and false positives. The most intensive and expensive strategy in the efficiency frontier, biennial mammography and CBE screening from the age of 40 years until 82 years, is estimated to prevent 9.8 breast cancer deaths and gain 49 QALYs at the expense of 4 overdiagnosed cases and 135 false positives per 1000 women. Meanwhile, the least intensive strategy on the efficiency frontier, triennial mammography screening from the age of 55 years until 64 years, is expected to avert 3.5 breast cancer deaths and gain 16 QALYs per 1000 women. However, this strategy is also estimated to have the smallest number of overdiagnoses and false positives, 1.2 and 37 cases per 1000 women, respectively.

Using a €12 720 WTP threshold, the optimal strategy for Georgia would be to screen using only mammography from the

Table 2. Simulated screening strategies: number of breast cancer deaths averted, overdiagnoses, false positives, QALYs gained, additional cost (€) per 1000 women aged 40 years followed until death compared with no screening, and ICER in (€).

Strategies	Breast cancer deaths averted*	Overdiagnoses*	False positives*	QALYs gained†	Additional Costs (€)†	ICER (€)
Current strategy						
Mammography and CBE Biennial 40-70 years	8.6	2.3	111	47.60	771 982	Dominated
Strategies on the efficiency frontier						
Mammography triennial 55-64 years	3.5	1.2	37	16.13	112 760	6991
Mammography triennial 52-64 years	4.2	1.4	42	20.84	149 587	7817
Mammography triennial 49-64 years	4.7	1.5	56	24.95	190 626	9994
Mammography triennial 48-66 years	5.3	1.7	62	27.64	219 340	10 658
Mammography triennial 45-66 years‡	5.7	1.8	71	31.40	266 402	12 507
Mammography biennial 47-65 years	6.5	2.0	78	35.74	324 099	13 293
Mammography biennial 45-67 years	7.3	2.4	93	40.40	391 870	14 559
Mammography biennial 41-69 years	8.1	2.7	106	44.39	461 069	17 333
Mammography biennial 41-71 years	8.5	2.9	112	45.23	478 132	20 469
Mammography biennial 40-70 years	8.4	2.9	108	46.07	496 405	21 628
Mammography biennial 40-72 years	8.8	3.1	114	46.80	512 599	22 275
Mammography biennial 40-74 years	9.1	3.3	119	47.30	527 071	28 796
Mammography biennial 40-76 years	9.3	3.5	124	47.58	539 860	45 247
Mammography biennial 40-78 years	9.4	3.7	128	47.76	550 950	63 458
Mammography biennial 40-80 years	9.5	3.8	131	47.83	560 321	131 047
Mammography and CBE biennial 40-82 years	9.8	4.0	135	49.42	881 486	201 849

Note: ICER of each frontier strategy was calculated based on the adjacent strategy with less gained QALYs.
CBE indicates clinical breast examination; ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year; WTP, willingness-to-pay.
*Per 1000 women, undiscounted.
†Per 1000 women with 3.0% discount.
‡Optimal strategy within WTP threshold.

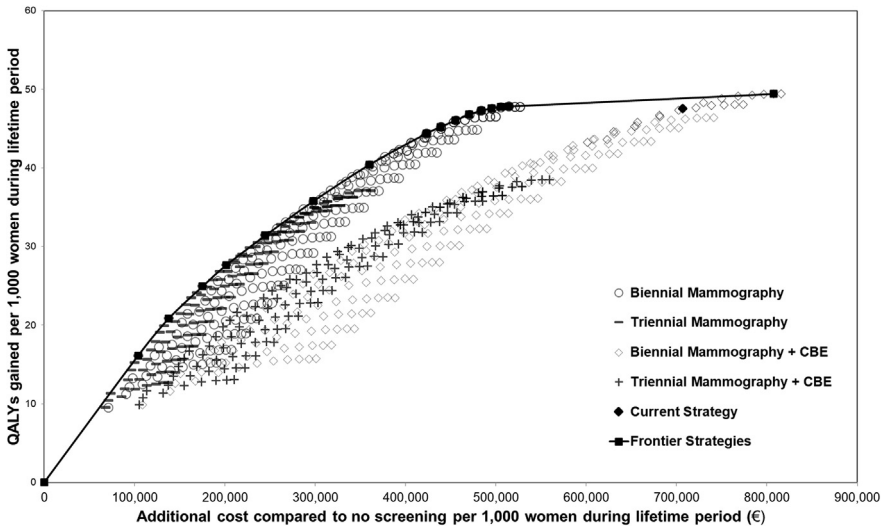
age of 45 years until 66 years every 3 years. This strategy is expected to prevent 5.7 breast cancer deaths and gain 31.4 QALYs at the expense of 1.8 overdiagnoses and 71 false positives per 1000 women. Although the estimated benefits gained from the optimal strategy is lower than the current strategy (assuming 100% attendance), the optimal strategy will require fewer screening rounds and will have less harms. Besides the additional cost of the optimal strategy is substantially lower (€266 402) than the current strategy (€771 982).

Another important finding from this analysis is that removing CBE while keeping the screening age and interval as currently implemented will result in minor reductions in health gains but a substantial reduction in cost.

Among strategies on the efficiency frontier, almost all are strategies using only mammography as the primary screening modality. Both biennial and triennial strategies are at the efficiency frontier. Triennial strategies are estimated to have less breast cancer deaths averted and QALY gains compared with biennial strategies. However, triennial strategies also require less additional costs and result in less false positives and overdiagnosed cases.

When additional cost per 1000 women of each strategy is plotted against the QALYs gained (Fig. 1), strategies using CBE are estimated to gain slightly higher QALYs but require substantially higher additional cost. This explains why there is only one CBE strategy on the efficiency frontier. The current strategy in Georgia is close to the efficiency frontier line. However, the additional cost

Figure 1. Cost-effectiveness curve of all simulated screening strategies: The discounted additional costs compared with no screening per 1000 women of all simulated screening strategies were plotted against the discounted QALYs gained per 1000 women.



CBE indicates clinical breast examination; QALY, quality-adjusted life-year.

per QALY gain compared with no screening is €16 218, which is above the assigned WTP threshold.

Adding CBE to mammography did not improve cost-effectiveness. Therefore, we only performed the sensitivity analyses for strategies using only mammography as the primary screening modality.

Regarding the sensitivity analyses (Table 3), most of the scenarios have triennial strategies as the optimal interval. Biennial strategies require more screening rounds and are optimal when having 10% lower referral rate, 10% lower costs, or lower mammography price. Except for using the Slovenian better survival and 5% annual discount rate, all scenarios indicated starting the screening before the age of 50 years is optimal. Stopping the screening before the age of 70 years is optimal in all scenarios.

Discussion

Offering mammography-only screening at the age of 45 years and stopping at the age of 66 years every 3 years is the optimal breast cancer screening in Georgia, using a WTP threshold of €12 720.

Table 3. Results of sensitivity analyses. The optimal breast cancer screening strategy based on different sensitivity analysis scenarios using a €12 720 WTP threshold.

Scenario	Optimal strategy			
	Starting age (years)	Stopping age (years)	Interval (years)	Screening rounds (n)
Base case	45	66	3	8
10% higher test sensitivity	45	69	3	9
10% lower test sensitivity	49	64	3	6
Higher mammography price (€55)*	49	64	3	6
Lower mammography price (€27)*	41	69	2	15
10% higher all cost	48	66	3	7
10% lower all cost	47	65	2	10
10% lower utility losses	48	66	3	7
10% higher utility losses	45	66	3	8
10% higher referral	48	66	3	7
10% lower referral	45	67	2	12
Improved survival (Slovenia)	52	64	3	5
5% discount rate	52	64	3	5

WTP indicates willingness-to-pay.
*Lower or higher mammography price is based on the cheapest or most expensive mammography price obtained from different clinics or oncology centers.

Combining mammography screening with CBE did not improve the cost-effectiveness because CBE did not improve the screening sensitivity substantially. A study reported that the incremental sensitivity attributed to adding CBE to mammography screening is only 4.4%.[15] This is in contrast with the substantial additional cost to perform CBE that has to be considered. In this analysis, the primary screening cost per woman in strategies which have a combination of CBE and mammography is almost 75% higher (€71.8) compared with mammography-only strategies (€41.1).

The optimal strategy based on this modeling study is to start screening at the age of 45 years. Starting mammography screening before the age of 50 years is currently being debated. A randomized trial has shown that offering annual screening to women aged 40 to 48 years resulted in a 25% breast cancer mortality reduction.[27] However, the harms of screening should also be considered. A modeling study estimated that extending the age ranges of mammography screening, including offering screening to women aged 45 to 49 years will result in more benefits at the expense of increased harms.[28] Currently, ECIBC recommends not to offer breast cancer screening to asymptomatic women aged 40 to 44 years, whereas asymptomatic women aged 45 to 49 years can be offered mammography screening either biennially or triennially.[14] The new European Union recommendation also extended the target ages for breast screening to include women between 45 and 74 years, from previous target ages between 50 and 69 years. Furthermore, the recommendation suggests member states to provide cancer screening for at least 90% of screen-eligible population.[29] Taking that into account, Georgia can invite more women using the proposed new strategy.

The optimal strategy based on this study, however, will leave women aged 40 to 44 years unscreened. This is a particular concern because currently implemented biennial 40 to 70 years old strategy is the only way for symptomatic women in Georgia to get diagnostic facilities covered by insurance. Therefore, in addition to optimizing the screening strategy, providing free access for symptomatic women who do not belong to screening-eligible group to have timely diagnostic procedures and treatment is recommended.

The MISCAN-Breast model also takes into account life expectancy when simulating different screening strategies. The women's life expectancy in Georgia is lower than the European Union average (78.4 and 84.0 years, respectively, in 2019).[11] Therefore, it is expected that the stopping age will be lower. This reasoning is echoed by the result of this modeling study. Instead of stopping at age 69 or 74 years similar to what many European countries are implementing, the optimal stopping age in Georgia using the assigned WTP threshold is 66 years.

Biennial strategies yielded in higher health gains and more harms compared with triennial strategies. However, biennial strategies will generally require more screening rounds, which may be challenging to implement in countries with capacity constraints. Furthermore, recent evidence, which considers improvements in breast cancer treatment, suggests that triennial strategies can also be optimal. An updated Dutch cost-effectiveness analysis showed that triennial screening from the age of 44 years until 71 or 74 years is estimated to gain more QALYs at lower cost compared with current Dutch biennial 50 to 74 years strategy.[5] In the Georgian context, switching to the optimal strategy will result in less health gains compared with the currently implemented biennial strategy. However, this will be compensated by the possibility to offer the screening to substantially more eligible women. Furthermore, less harms are expected when switching to the optimal strategy. The varying optimal strategies yielded by different sensitivity analysis scenarios may give a perspective on how these results can be generalized to other Eastern European countries.

Only a few other studies have evaluated cost-effectiveness of breast cancer screening in this region. However, those studies evaluated fewer number of strategies. A cost-effectiveness analysis on mammography screening in Kazakhstan showed that biennial screening from the age of 50 until 60 years is cost-effective.[30] Another study from Slovenia showed that out of 36 evaluated strategies, the optimal strategy for Slovenia is to screen from the age of 40 until 80 years every 3 years.[31] Although our analysis agrees with the chosen interval of the Slovenian study, there are differences regarding the optimal screening age. The differences might be caused by differences in assumptions on natural history of disease, test sensitivity at younger age, life expectancy, costs, WTP threshold, and the number of evaluated strategies.

The major limitation of this study is the lack of some information required during the adaptation of the MISCAN-Breast model into the Georgian situation (eg, cancer detection rates and the difference in stage distribution between screen detected and clinically detected cancers). Publicly available information on costs, cost structures, and utilities are also very limited; thus, some assumptions were adapted from other countries or other sources in which its generalizability is difficult to evaluate. This is a common limitation when evaluating cancer screening programs in limited resource settings where infrastructure to perform data collection and routine monitoring is not yet well established. However, the Georgian cancer registry has provided most of the essential epidemiological information needed to adapt the model such as age-specific breast cancer incidence, mortality, and stage distribution of detected cancer.

The second limitation is that societal perspective approach was not taken in this analysis because of unavailability of societal costs information in Georgia. If societal costs were considered, and knowing the fact that the highest reported further assessment rate in Europe is 10.3%,[32] it is expected that societal costs attributed to participation to primary screening will be the biggest costs addition. It implies that strategies with fewer screening rounds will still be cheaper. Thus, triennial screening strategies may still be favored in the societal perspective analysis similar to the current analysis using the healthcare payer perspective.

Not many countries use CBE on top of mammography in the context of organized primary screening. Therefore, there is currently limited knowledge on how much reduction on sensitivity when CBE is removed from combined mammography and CBE screening. This is another limitation of this study. In this analysis, we used 4.4% sensitivity reduction for mammography-only strategies based on a study published in 2005.[15] However, addressing this uncertainty with a sensitivity analysis will be very unlikely to change the message that supplementing CBE in mammography screening does not improve cost-effectiveness. The more wide-spread use of digital mammography, which has superior test characteristics, make it very likely that the incremental sensitivity contribution of CBE is currently even lower than 4.4%.

Lastly, the use of 100% participation assumption in this study may raise questions because current screening participation in Georgia is only around 10%. However, performing a sensitivity analysis using a lower and realistic participation is difficult because of the absence of information regarding how screening participation is distributed throughout the population. Assuming lower and realistic participation, which distributed equally and in a random manner throughout the country, does not reflect the reality in Georgia. This will also overestimate the impact of screening. Screening may also be performed to only a small group of women with the recommended interval. Alternatively, screening can also be performed more equally throughout the

country but with a longer actual interval. Those different scenarios will result in different outcomes, thus resulting in very different optimal strategies. Not having information on participation distribution from a reliable source (eg, national screening registry) to simulate lower and realistic participation, will result in potentially misleading recommendation.

Conclusions

To the best of our knowledge, this is the first breast cancer screening cost-effectiveness study evaluating an extensive number of strategies for an Eastern European country. For Georgia, using a WTP threshold of €12 720, the optimal strategy is mammography-only screening from the age of 45 until 66 every 3 years. Removing CBE as primary screening modality will reduce cost substantially with minimal reduction in health gains.

Although switching from biennial to triennial screening will potentially increase the occurrence of interval cancers and reduce health benefits of screening, it is predicted to still gain a substantial amount of screening benefits, reduce harms of screening, and reduce cost. Furthermore, triennial screening may allow countries to invite more eligible women. In the end, triennial mammography screening can still have substantial population impact especially in limited resource settings. This study may serve as an example for other Eastern European countries that have similar barriers and circumstances.

Author Disclosures

Links to the individual disclosure forms provided by the authors are available here.

Supplemental Material

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.vhri.2023.09.002.

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