COST-EFFECTIVENESS OF DIGITAL MAMMOGRAPHY IN A BREAST CANCER POPULATION-BASED SCREENING PROGRAM

Comas M[1], Arrospide A[2], Mar J[2], Román R[1], Sala M[1], Hernández C[1], Castells X[1]
1. Hospital del Mar-IMIM, CIBER de Epidemiología y Salud Pública (CIBERESP), Barcelona, Spain
2. Hospital Alto Deba, Mondragon, Spain

OBJECTIVES

The introduction of digital mammography presents benefits at the technological and logistic level. However, there is a debate about the impact of changing from analogical to digital mammography on the effectiveness of breast cancer screening. The aim of this study was to analyze the cost-effectiveness of the introduction of digital mammography in a population-based breast cancer screening program.

METHODS

A discrete-event simulation model was implemented including the processes under a breast cancer screening program and the natural history of breast cancer. The screening events are depicted in Figure 1. Women aged 50-69 years were invited biennially to the program. Natural history of breast cancer included the following health states: no cancer, pre-clinical (non symptomatic) cancer, clinical (or symptomatic) cancer and death. Natural history was modeled as time until a change of health state, and health states were managed using attributes in order to condition the sensitivities and specificities of the tests to the current health state of the woman. Interval cancers were also detected according to the health state. Digital and analogical mammography had the same sensitivity, but different specificities were applied according to type of mammography and also initial or successive screening (Table 1). Stage of detection was assigned according to whether it was detected under screening or clinically, by age and by type of mammography. All the parameters were obtained from the Parc de Salut Mar Breast Cancer Screening Program, except the cost of mammography (obtained from the Basque Country Breast Cancer Screening Program), and the time distributions for the natural history of the disease, utilities and costs of additional tests (obtained from the literature). Cost-effectiveness was calculated under a 20 year screening scenario and 100 simulations.

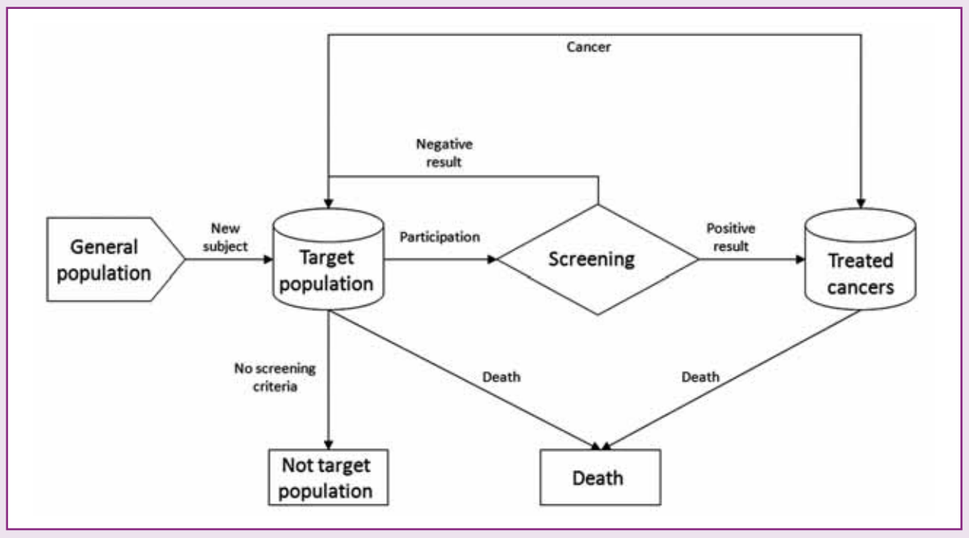

Figure 1: Conceptual model for the screening process.

Table 1: Sensitivity and specificity values by type of mammogram and screening number.

	Digital mammography		Screen-film mammography	
	Sensitivity	Specificity	Sensitivity	Specificity
Initial screening	0.954	0.888	0.954	0.883
Successive screening	0.954	0.958	0.954	0.954

RESULTS

Table 2: Recall rate and rates of additional procedures according to type of mammogram.

	Digital mammography		Screen-film mammography	
	N	%	N	%
Global data				
Women screened	90,800		90,800	
Screening mammograms	277,582		277,584	
Recall for further assessment				
Recall rate	16,378	5.9%	17,469	6.3%
Further assessments				
Additional mammograms	6,935	2.5%	10,329	3.7%
Ultrasound (US)	12,657	4.6%	13,781	5.0%
Fine-needle aspiration cytology (FNAC)	4,327	1.6%	7,559	2.7%
Core biopsy	995	0.4%	1,671	0.6%
Open surgical biopsy	107	0.04%	558	0.2%

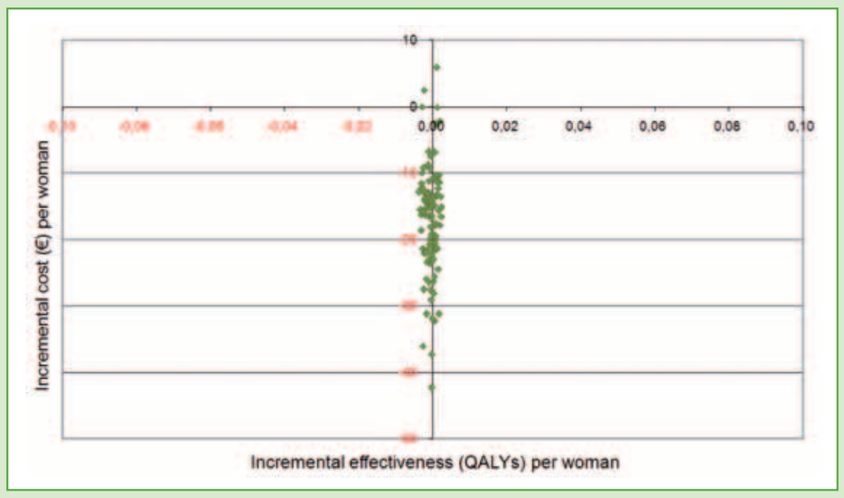

Figure 2: Incremental cost-effectiveness plane.

Table 3: Cost-effectiveness results of digital mammography compared to screen-film mammography.

	Digital mammography		Screen-film mammography		Difference	
	Mean	SD	Mean	SD	Mean	SD
Cost-effectiveness with discount						
Costs						
Overall cost	19,133,636	1,049,501	20,646,397	973,868	-1,512,761	742,180
Screening	8,671,918	105,136	7,869,615	93,401	802,303	51,908
Additional tests	2,570,798	155,869	4,467,516	241,912	-1,896,719	296,055
Cancer treatment	7,815,905	1,008,527	8,229,453	894,323	-413,548	712,468
Overall cost per invited woman	214.04	11.74	230.97	10.89	-16.92	8.30
QALYs						
Overall QALYs	936,719	10,922	936,757	10,920	-38.48	129.59
QALYs per invited woman	10.4788	0.12219	10.4792	0.12216	-0.0004	0.0014
Incremental cost-effectiveness ratio (ICER)						
Overall	39,315					

**All differences statistically significant at the 0,05 level*

CONCLUSIONS

Results suggest that population-based breast cancer screening with digital mammography has similar effectiveness than screening with analogical mammography. Although differences in specificity are low, they have an impact on lowering the number of recalls and, thus, the number of additional tests. This reduction in cost, in addition to a reduction in the cost of treatments due to an earlier stage at detection under digital mammography, clearly compensates the higher cost of screening with digital mammography.

Funding: This work was supported by grants from Instituto de Salud Carlos III FEDER, (FIS PI07/90357).

Hospital del Mar

Parc de Salut MAR Barcelona