VALUE IN HEALTH 21 (2018) 78–88

Available online at www.sciencedirect.com

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journal homepage: www.elsevier.com/locate/jval

Women's Benefits and Harms Trade-Offs in Breast Cancer Screening: Results from a Discrete-Choice Experiment

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ABSTRACT

Background: Over the past decade, the benefits and harms balance of breast cancer (BC) screening has been widely debated. **Objectives:** To elicit women's trade-offs between the benefits and harms of BC screening and to analyze the main determinants of these trade-offs. **Methods:** A discrete-choice experiment with seven attributes depicting BC screening programs including varying levels of BC mortality, overdiagnosis, and false-positive result was used. Eight hundred twelve women aged 40 to 74 years with no personal history of BC recruited by a survey institute and representative of the French general population (age, socioeconomic level, and geographical location) completed the discrete-choice experiment. Preference heterogeneity was investigated using generalized multinomial logit models from which individual trade-offs were derived, and their main determinants were assessed using generalized linear models. Screening acceptance rates under various benefits and harms ratios were simulated on the basis of the distribution of individual preferences. **Results:** The women would be willing to accept on average 14.1 overdiagnosis cases (median = 9.6) and 47.8 false-positive results (median = 27.2) to avoid one BC-related death. After accounting for preference heterogeneity, less than 50% of women would be willing to accept 10 overdiagnosis cases for one BC-related death avoided. Screening acceptance rates were higher among women with higher socioeconomic level and lower among women with poor health. **Conclusions:** Women are sensitive to both the benefits and the harms of BC screening and their preferences are highly heterogeneous. Our study provides useful results for public health authorities and clinicians willing to improve their recommendations of BC screening on the basis of women's preferences.

Keywords: benefits and harms balance, breast cancer screening, discrete-choice experiment, overdiagnosis, preference heterogeneity, willingness to accept.

Introduction

Breast cancer (BC) is one of the leading causes of cancer deaths around the world. Studies published in the mid-1990s showed that early detection through screening plays an important role in reducing the morbidity and mortality of cancer [1,2]. Till recently, the effectiveness of screening mammography has been widely acknowledged, and national screening programs have been initiated in most developed countries, where health authorities have relied on similar recommendations, that is, a screening periodicity of 2 to 3 years among women aged 45 or 50 years to 69 or 74 years [3–5]. Much of the research to date has focused on assessing the cost-effective level of BC screening uptake or evaluating interventions to increase BC screening participation [6,7]. In 2012, only 9 of the 26 European programs had achieved the desirable level of 75% participation rate [4], and in France, only 62% of eligible women (i.e., aged 50–74 years) had received a mammogram in the past 2 years according to recommendations [8]. In France, as in many member countries of the Organisation for Economic Co-operation and Development, a national program for BC has been implemented: an invitation is mailed to women aged 50 to 74 years to receive a "free" mammogram in a local screening center. They can also be screened outside the national program on the basis of a doctor's prescription (opportunistic screening), and in practice, women with one or more risk factors can be prescribed a mammogram by their general practitioner (GP) or gynecologist from the age of 40 years.

Nevertheless, there has been a large debate regarding the benefits and harms of BC screening [9–13] and it has been argued that harms have not been given equal attention compared with benefits in scientific articles [14]. Particularly, overdiagnosis and false-positive mammography are well-documented harms [15]. Overdiagnosis usually refers to the diagnosis and treatment of ductal carcinoma in situ (i.e., noninvasive BC) that may not have become life-threatening [12]. In reality, the diagnosis process appears in detection, diagnosis, and treatment, thus potentially leading to overdetection, overdiagnosis, and overtreatment. Overtreatment is a direct consequence of overdiagnosis. Our study focuses on overdiagnosis. Estimation of the prevalence of overdiagnosis varies according to the studies, ranging from less

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1098-3015$36.00 – see front matter

http://dx.doi.org/10.1016/j.jval.2017.07.003

Table 1 – Definition of attributes and levels.

Attribute	Definition	Levels for screening programs	Levels for the opt-out program
BC mortality	Total number of BC deaths out of 1000 women followed until age 74 y	10, 15, 20, 25	30
False-positive	Number of women undergoing *unnecessary investigations* (e.g., biopsy) because of suspicious findings on the mammograms that do not result in BC diagnosis, out of 1000 women screened until age 74 y	50, 100, 150, 200	0
Overdiagnosis	Number of women undergoing *unnecessary treatments* (e.g., chemotherapy and radiotherapy) because of detection of a noninvasive cancer that would not have become life-threatening, out of 1000 women screened until age 74 y	10, 50, 100, 150	0
Type of screening referral	Invitation to perform a mammogram by 1) the local screening center* or 2) your doctor (GP or gynecologist)	1. "Letter" 2. "Doctor"	–
Travel time	Time spent traveling to the radiology center (min)	10, 30, 60, 90	0
No. of tests	Total number of screening tests until age 74 y	6, 12, 18, 24	0
Out-of-pocket cost	Cost of screening after reimbursement by the public health insurance	€0, €30, €60, €60 (refunded)†	0

BC, breast cancer; GP, general practitioner.
* Standard procedure for inviting women aged 50–74 y eligible to the national BC screening program (organized screening).
† The modality "€60 refunded" means that women had to advance fees, which would be reimbursed later.

than 1 overdiagnosis case to more than 10 overdiagnosis cases per BC death prevented [11,13,15]. Another harm of screening is false-positive mammography [12,13], resulting in both unnecessary biopsies and increased distress and anxiety related to a possible diagnosis of cancer [16]. Estimated 10-year cumulative risk of false-positive mammography varies from 4.8% to 9.4% depending on age at first screen and screening interval [17].

Despite these debates, little is known about women's preferences and the following questions remain unsolved: What are women's trade-offs between the benefits and harms of mammography? How do these trade-offs vary according to women and what are their main determinants? Analyzing women's preferences for BC screening using a discrete-choice experiment (DCE) could bridge this gap. In the past 10 years, DCEs have been increasingly used in health care research to investigate patients, public, and health professionals' preferences for medical procedures or treatments [18,19]. The DCE methodology was applied to analyze public preferences for cancer screening programs, with most of the studies on colorectal cancer screening [20–22] and three studies on BC screening [23–25]. The results of these studies allowed prioritization of cancer screening attributes such as mortality risk reduction, waiting time or out-of-pocket (OOP) costs, and estimation of willingness-to-pay (WTP) values for reducing cancer mortality risk [23]. Yet, important attributes characterizing BC screening have not been taken into account such as the risk of additional invasive examinations (i.e., false-positive mammography) and additional treatments related to overdiagnosis.

Using a DCE based on a representative sample of French women, this study aimed to measure women's preferences for BC screening programs and to estimate for the first time their trade-offs between the benefits and harms of mammography. As a "one-size-fits-all" approach of women preferences can be a suboptimal way of designing screening services, another approach could be to account for preference heterogeneity and to analyze their main determinants using sociodemographic, health, and attitudinal variables collected from the survey.

Methods

The Discrete-Choice Experiment

In a DCE, participants are asked to make choices between several hypothetical scenarios offering different combinations of attributes to infer their preferences for each attribute independently [26]. The first step is selecting attributes and levels, the second step is choosing an appropriate design for building the choice scenarios, and the third step is sampling respondents and collecting data.

Selection of attributes and levels

The selection of attributes and levels for BC screening was based on two complementary stages: a literature review and a qualitative phase including two focus groups (with a total of eight participants) and seven semistructured interviews. The 15 participants were recruited in Lyon and Paris areas between October and December 2015. A thematic analysis of responses was conducted on the basis of audio recordings and written notes of meetings and interviews [27–29]. The thematic analysis of responses focused on themes related to the perceived advantages and drawbacks of mammography as well as women's experience and knowledge of BC screening. We identified seven BC screening attributes to include in the hypothetical screening programs (Table 1): BC mortality, false-positive mammography, overdiagnosis, type of screening referral, number of screening tests, time spent traveling, and OOP cost (see File 1 in Supplemental Materials found at http://dx.doi.org/10.1016/j.jval.2017.07.003 for a detailed presentation of attributes as shown to respondents). The analysis on the information presented in decision aids or in the medical literature [15,30,31] allowed us to define plausible levels for BC mortality, false-positive mammography, and overdiagnosis. Except for the prescribing physician, all attributes were expected to have negative impacts on the utility derived from the screening program. For instance, increasing the number of false-positive mammography in a screening program would decrease the probability of women choosing this program. The impact of