Patient Education and Counseling 99 (2016) 1647–1656

Contents lists available at ScienceDirect

Patient Education and Counseling

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

Effects of a risk-based online mammography intervention on accuracy of perceived risk and mammography intentions

Holli H. Seitz[a,*], Laura Gibson[a], Christine Skubisz[a,1], Heather Forquer[a], Susan Mello[a,2], Marilyn M. Schapira[b,c], Katrina Armstrong[b,3], Joseph N. Cappella[a]

[a] Annenberg School for Communication, University of Pennsylvania, 3620 Walnut Street, Philadelphia, PA, 19104, USA
[b] Perelman School of Medicine, University of Pennsylvania, 3400 Civic Center Blvd, Philadelphia, PA 19104, USA
[c] Center for Health Equity Research and Promotion, Crescenz VA Medical Center, Philadelphia, PA 19104, USA

ARTICLE INFO

Article history:
Received 3 October 2015
Received in revised form 19 April 2016
Accepted 2 May 2016

Keywords:
Risk communication
Communication intervention
Decision aid
Mammography
Perceived risk
Numeracy

ABSTRACT

Objective: This experiment tested the effects of an individualized risk-based online mammography decision intervention. The intervention employs exemplification theory and the Elaboration Likelihood Model of persuasion to improve the match between breast cancer risk and mammography intentions.
Methods: 2918 women ages 35–49 were stratified into two levels of 10-year breast cancer risk (<1.5%; ≥1.5%) then randomly assigned to one of eight conditions: two comparison conditions and six risk-based intervention conditions that varied according to a 2 (amount of content: brief vs. extended) x 3 (format: expository vs. untailored exemplar [example case] vs. tailored exemplar) design. Outcomes included mammography intentions and accuracy of perceived breast cancer risk.
Results: Risk-based intervention conditions improved the match between objective risk estimates and perceived risk, especially for high-numeracy women with a 10-year breast cancer risk ≤1.5%. For women with a risk ≤1.5%, exemplars improved accuracy of perceived risk and all risk-based interventions increased intentions to wait until age 50 to screen.
Conclusion: A risk-based mammography intervention improved accuracy of perceived risk and the match between objective risk estimates and mammography intentions.
Practice implications: Interventions could be applied in online or clinical settings to help women understand risk and make mammography decisions.

1. Introduction

The U.S. Preventive Services Task Force (USPSTF) [1] recommends that women between the ages of 40 and 49 make a decision about mammography based on their evaluation of its risks and benefits. In 2015, the American Cancer Society (ACS) recommended that women begin routine mammography at age 45 [2]. Some medical organizations recommend that women start at age 40 [3,4]. This means that women below the age of 50 have an important health decision to make. However, many women are not equipped to make informed decisions because they have little knowledge of screening guidelines, the predictive validity of mammograms, or their personal risk for breast cancer (BC) [5–7]. In prior research, 44.1% of female participants overestimated the risk of having BC, and 68.1% overestimated the risk of dying from BC [6].

Poor understanding of objective estimates of BC risk contributes to a poor match between objective risk and screening. Though a positive link between perceived risk and mammography screening has been reported [7–10], the relationship between objective risk estimates and screening has been less well documented. In fact, research has shown that risk factors used to estimate objective risk do not predict screening behavior [11] and that perceived and objective risk are independent predictors of screening behavior [9], suggesting that the correlation between objective risk and screening is imperfect. Since perceived risk does predict mammography,

* Corresponding author.
E-mail addresses: hollihseitz@gmail.com, http://null (H.H. Seitz), lgibson@asc.upenn.edu (L. Gibson), christine_skubisz@emerson.edu (C. Skubisz), heather.forquer@gmail.com (H. Forquer), s.mello@northeastern.edu (S. Mello), mschap@mail.med.upenn.edu (M.M. Schapira), karmstrong6@mgh.harvard.edu (K. Armstrong), jcappella@asc.upenn.edu (J.N. Cappella).
[1] Present address: School of Communication, Emerson College, 120 Boylston Street, Boston, MA, 02116, USA.
[2] Present address: Department of Communication Studies, Northeastern University, 360 Huntington Avenue, Boston, MA, 02115, USA.
[3] Present address: Department of Medicine, Massachusetts General Hospital, 55 Fruit Street, Boston, MA, 02114, USA.

http://dx.doi.org/10.1016/j.pec.2016.05.005
0738-3991/

increasing the match between perceived risk and objective estimates of risk should improve the match between estimated objective risk and mammography.

Communication interventions have shown some success in changing perceived risk and mammography behavior. In a study of the effects of a mammography decision tool on women in their 40s and 50s, Rimer et al. [12,13] demonstrated the effectiveness of a tailored booklet and a tailored booklet plus telephone counseling in changing perceived BC risk compared to a usual care condition. The counseling group also showed an increase in mammography at short-term and long-term follow-up. Additionally, a decision aid for young women [14] increased both the likelihood of making a decision about whether or not to screen and the likelihood of deciding to delay mammography. In both of these situations, becoming more informed about the risks and benefits of mammography helped women make screening decisions that were appropriate for their level of risk (based on age), though the authors of these studies did not comment explicitly on the match between estimates of objective risk and behavior. Based on prior literature, we predicted that, compared to comparison conditions, women receiving interventions with individualized risk information would experience improved accuracy of perceived risk, women with an estimated 10-year BC risk $\leq$ 1.5% who received the intervention would report increased intentions to begin mammography at age 50, and women with an estimated 10-year BC risk $\geq$ 1.5% who received the intervention would report increased intentions to start or continue mammography in their 40s.[5]

Rimer et al. [12,13] and Mathieu et al. [14] did not report any moderators of effects, such as numeracy, which has been shown to predict ability to interpret representations of BC risk [17]. Prior research suggests that less numerate individuals are more influenced by the format in which risk information is presented and more influenced by nonnumerical information than are more numerate individuals [18]. Therefore, we expected that numeracy would moderate the effects of providing risk information on perceived risk and mammography intentions; more numerate women who saw the numeric risk-based intervention should have more accurate perceived risk and a better match between estimates of objective risk and behavior than less numerate women.

Another aspect missing in prior studies is the experimental manipulation of communication elements shown to have an impact on perceived risk and behavior, specifically exemplars (example cases) and tailoring. Exemplification theory predicts that exemplars can be used to shape an individual's perceptions of a particular issue [19]. Zillmann found that exemplars presented as part of a message are often more memorable than numeric risk information presented in the message itself and have a stronger effect on perceived risk than numeric risk [19]. Because individuals with low numeracy tend to be more influenced by nonnumeric information [18], using exemplars to model risk-based decision-making may also improve the match between risk and intentions, even when numerical risk information is not well understood. Specifically, we predicted that exemplars (example women presented in the intervention making a decision to screen or delay mammography) would have a stronger effect on perceived risk and intentions than aggregate statistical information presented without exemplars.

Table 1
Condition components.

	Conditions						
	Comparison conditions		Risk-based intervention conditions				
	Comparison: no information	Comparison: basic info	Brief intervention + expository	Brief intervention + untailored exemplars	Brief intervention + tailored exemplars	Extended intervention + expository	Extended intervention + untailored exemplars	Extended intervention + tailored exemplars
Participants with 10-year breast cancer risk <1.5%	No information	Basic information	Brief intervention + Expository reasons women wait to have mammograms at 50 (3 for, 1 against waiting)	Brief intervention + Exemplar who is undecided, lists reason for and reason against waiting; Exemplar who is waiting, list 2 reasons for waiting	Brief intervention + Risk-, age-, race-matched exemplar who is undecided, lists reason for and reason against waiting; Risk-, age-, race-matched exemplar who is waiting, lists 2 reasons for waiting	Extended intervention + Expository reasons women wait to have mammograms at 50 (3 for, 1 against waiting)	Extended intervention + Exemplar who is undecided, lists reason for and reason against waiting; Exemplar who is waiting, lists 2 reasons for waiting	Extended intervention + Risk-, age-, race-matched exemplar who is undecided, lists reason for and reason against waiting; Risk-, age-, race-matched exemplar who is waiting, lists 2 reasons for waiting
Participants with 10-year breast cancer risk ≥1.5%	No information	Basic information	Brief intervention + Expository reasons women have mammograms at 40 (3 for, 1 against screening)	Brief intervention + Exemplar who is undecided, lists reason for and reason against screening; Exemplar who is screening, lists 2 reasons for screening	Brief intervention + Risk-, age-, race-matched exemplar who is undecided, lists reason for and reason against screening; Risk-, age-, race-matched exemplar who is screening, list 2 reasons for screening	Extended intervention + Expository reasons women have mammograms at 40 (3 for, 1 against screening)	Extended intervention + Exemplar who is undecided, lists reason for and reason against screening; Exemplar who is screening, lists 2 reasons for screening	Extended intervention + Risk-, age-, race-matched exemplar who is undecided, lists reason for and reason against screening; Risk-, age-, race-matched exemplar who is screening, list 2 reasons for screening

[5] See Section 2.2 for a description of how participants were divided into two strata of risk. The risk threshold of 1.5% used in this research was chosen to reflect the 90th percentile of 10-year risk for 50-year-old women, calculated using the Gail model [15] and data from NHANES III [16].