Original Article

The Angelina Effect Revisited: Exploring a Media-Related Impact on Public Awareness

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BACKGROUND: In 2013, Angelina Jolie's double mastectomy and publication of her personal treatment choice for *BRCA1* positivity generated considerable media attention. To the authors' knowledge, the current study is the first prospective survey conducted among the general public to measure a quantifiable media-related effect on public awareness. **METHODS:** The authors analyzed the changes in the general public's awareness of reconstructive options in breast cancer among 2 female population-matched cohorts aged 18 to 65 years (1000 participants in each cohort) before (March 2013; poll 1) and after (June 2013; poll 2) the announcement of Ms. Jolie's mastectomy in May 2013. **RESULTS:** There was an observed increase in public awareness: significantly more women from poll 2 were aware of reconstructive breast surgery being possible after breast cancer-related mastectomy, notably with regard to autologous tissue and single-stage reconstructions. Approximately 20% of the women in poll 2 (205 women) indicated that media coverage regarding Ms. Jolie affected their interest in breast cancer. A question that was exclusive to poll 2 revealed a preference for autologous (66.2%) versus implant-based (8.2%) reconstructions, with the remainder indicating no preference (25.6%). None of the stratification variables were found to be associated with the above findings. **CONCLUSIONS:** To the best of the authors' knowledge, this is the first prospective study to demonstrate a statistically significant impact of a celebrity announcement on public awareness regarding breast cancer treatment. The results underscore the importance of a media-related impact for professionals in the health care sector, which can serve as a tipping point for raising awareness and improving knowledge concerning a specific disease among the general public. ***Cancer* 2015;000:000-000.** © *2015 American Cancer Society.*

KEYWORDS: breast cancer, mastectomy, plastic surgery, reconstructive surgery, prospective, survey, media-related effect, celebrity announcement.

INTRODUCTION

In May 2013, *Time* published a cover story about the "Angelina effect," relating to Angelina Jolie's decision to undergo a double mastectomy and breast reconstruction in the presence of a mutation of the *BRCA1 gene*.[1,2] The incident generated considerable media attention[3,4] on a relatively small risk group of approximately 5% of breast cancer cases.[5,6] Breast cancer was the second leading cause of deaths among women in 2013.[7]

In 1974, the American sociologist David Phillips described the "Werther effect,"[8] which alluded to the first scientifically described media-triggered suicides, in the style of Goethe's fictional character at the end of the 18th century.[9] "The Reeve effect" refers to actor Christopher Reeve's accident and the impact of his foundation on public awareness of spinal cord injuries.[10] Among celebrities following suit by going public with their personal medical history were Nancy Reagan, Kylie Minogue, Katie Couric, and Jade Goody.[11] In 2012, one study evaluated a positive media-related effect in health care and observed an increase in the number of individuals registering as organ donors after an online recruitment campaign via social media.[12] All these cases demonstrated that media played an influential role in affecting an individual's behavior or willingness to deal with a health-related/disease-related issue.

To the best of our knowledge, no study to date has demonstrated a quantifiable media-related effect on public awareness after a celebrity announcement of breast cancer-related treatment.

In a serendipitously developed study, we analyzed changes in the general public's awareness of reconstructive options after surgical treatment for breast cancer among a female population-matched cohort 1 month before media-related reports on Ms. Jolie's mastectomy in May 2013, and repeated this survey 1 month thereafter.

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MATERIALS AND METHODS

In cooperation with the Austrian Gallup Institute (Karmasin Motivforschung, Das Oesterreichische Gallupinstitut, Vienna, Austria), we conducted 2 surveys (1000 participants each) among females aged 18 to 65 years regarding breast cancer and surgery in March 2013 (poll 1, "pre-Angelina") and June 2013 (poll 2, "post-Angelina"). The intent of the original first survey (March 2013) was to depict the female general public's awareness of their own breasts (unpublished data), perceptions about reconstructed breasts (unpublished data), and knowledge of interventions related to breast cancer. After Ms. Jolie's announcement in May 2013, we repeated the survey in June 2013 omitting 4 questions related to aspects of the breasts and nipple-areola complexes, as well as personal perceptions of breast reconstruction and related surgery in daily life.

After sample size estimation, matching by female sex, state, and age preceded prestratified multitiered cluster sampling (random sampling) to meet the criteria of a representative survey matched to the Austrian population (8.5 million), in which 8 of 10 households (80.9%) were equipped with a high-speed Internet access in 2013.[13] The poll was conducted nationwide and based on an online panel selection (written consent for online recruitment was obtained based on previous study-unrelated household or on-site interviews by the Austrian Gallup Institute), resulting in a response rate of 35.1%. The participants of the first poll were not recruited for the second. No financial incentive for participation was offered. Plausibility was evaluated by a computerized pre-run of the data (100%) and by response checks (100%). To compare both polls, we analyzed the following stratification variables: age (stratified in groups of 18-29 years, 30-49 years, 50-59 years, or 60-65 years), education (minimum required educational level, completed professional training/mid-level school, high school graduate, or achieved college or university degree), occupation (freelance/senior executive, employed/public officer, laborer/farmer/technician, or no occupation), number of inhabitants (<5000, <50,000, >50,000, or Vienna [representing a population of 1.74 million]), marital status (single, married/civil union, divorced/separated, or widowed), net income in Euros (<1200, 1201-1500, 1501-2000, 2001-2500, 2500-3000, >3000, or not available), number of individuals per household (1, 2, 3, 4, 5, 6, or >6), and number of children per household (0, 1, 2, 3, 4, or >4).

The questions regarding breast cancer and surgery (Table 1) predominantly required simple yes/no answers (questions A, C, D, E, F, and G), and questions B and H required a multiple selection of 4 choices (yes, myself/yes, a friend/yes, and a relative/no) and 3 choices (your body's own tissue, implants, and "do not know"), respectively. Questions G and H were only posed during the second survey.

The poll 1 collective was a priori excluded for participation in poll 2. The 2 questions that were exclusive to poll 2 were added for separate analysis of this collective with regard to the reporting about Ms. Jolie. The aim was to detect a subjective influence on the "dealing with the topic of breast cancer" by the media reports on Ms. Jolie (question G), and whether any preference for autologous versus implant-based reconstruction after breast cancer existed (question H).

Statistical Analysis

As a result of differences between polls with respect to stratification variables, a propensity score method was applied to rule out the influence of any confounding factors. The Toolkit for Weighting and Analysis of Nonequivalent Groups (R package twang 1.4-0, The R Project for Statistical Computing, Vienna, Austria) was used.

Boosted logistic regression iteratively calculated weights for each participant to achieve equality between both polls with respect to stratification variables. The equality measure was the sum of the chi-square statistics of the Pearson test of the stratification variables. The calculation of weights was supervised by diagnostic plots.[14] The answer to question G and its association with other questions was investigated by propensity-adjusted logistic regression using the R package survey 3.30-3 (The R Project for Statistical Computing). P values $<.05$ were considered to be statistically significant and R statistical software was used for statistical analysis (version 3.1.1; The R Project for Statistical Computing).

RESULTS

Approximately 88.9% of the participants in poll 1 were aware of the possibility of breast reconstruction after a mastectomy for breast cancer. This percentage increased to 92.6% among participants in poll 2 (4% absolute increase) after Ms. Jolie's announcement (question C: odds ratio [OR], 1.578; $P = .004$). A comparable increase from poll 1 to poll 2 was observed for questions relating to autologous (question E: 57.6% for poll 1 vs 68.9% for poll 2; OR, 1.631 [$P = 1.5e-07$]), and single-stage (question F: 40.5% for poll 1 vs 59.5% for poll 2; OR, 2.161 [$P = 1.4e-17$]) breast reconstruction. Implant-based breast reconstruction (question D) was a familiar option for the majority of participants in poll 1 (87.4%) and poll 2 (88.9%) ($P = .08$) (Table 1).

TABLE 1. Content and Sequence of Questions in Both Surveys: Propensity Scored-Adjusted Analysis

No.	Question	Poll 1: "Pre-Angelina," of 1000 Women	Poll 2: "Post-Angelina," of 1000 Women	*P*	OR
A	Have you ever been operated on your breast(s)?	59 (5.9%)	67 (6.7%)	.29	1.2160
B	Have you ever had to look into the topic of breast cancer in relation to yourself or a close relative?				
B_1	Yes, myself	48 (4.8%)	48 (4.8%)	.94	1.0162
B_2	Yes, a friend	336 (33.6%)	355 (35.5%)	.37	1.088
B_3	Yes, a relative	215 (21.5%)	226 (22.6%)	.54	1.068
B_4	No	447 (44.7%)	425 (42.5%)	.34	0.917
C	Do you know that it is possible to reconstruct the breast(s) after removal of one or both breasts in the context of breast cancer treatment?	889 (88.9%)	926 (92.6%)	.004	1.578
D	Do you know that breast reconstruction is possible by the use of silicone implants?	874 (87.4%)	899 (89.9%)	.08	1.281
E	Do you know that breast reconstruction is possible by the use of your body's own tissue?	576 (57.6%)	689 (68.9%)	1.5e-07	1.631
F	Do you know that in case of surgical removal of the affected breast, it is possible to simultaneously reconstruct this breast in the same operative session?	405 (40.5%)	595 (59.5%)	1.4e-17	2.161
Recent media reports have extensively covered the actress Angelina Jolie's operation, in which both of her breasts were removed. Because of a genetic predisposition, she has a very high risk of developing breast cancer (poll 2 exclusive questions (n/a for poll 1), of 1000 women).					
G	Has the related media coverage made you deal more intensively with the topic of "breast cancer"?				
	Yes	NA	205 (20.5%)		
	No	NA	795 (79.5%)		
H	In the case of reconstruction of the breast, would you generally prefer…				
	Your body's own tissue	NA	662 (66.2%)		
	Implants	NA	82 (8.2%)		
	Do not know	NA	256 (25.6%)		

Abbreviations: NA, not applicable; OR, odds ratio.

There were statistically significant differences between the polls with regard to education ($P = 2.5e-09$), profession ($P = 1.7e-08$), number of inhabitants ($P = .011$), number of children per household ($P = .019$), and marital status ($P = 3e-05$) (Table 2). None of the questions was found to be associated with any of these variables in statistical tests for association, and propensity score-adjusted logistic regression analysis was performed with adjustments with respect to all strata.

In poll 2, approximately 20% of the women (205 women) indicated that media coverage of Ms. Jolie's mastectomy made them "deal more intensively with the topic of breast cancer" (question G), and none of the stratification variables was found to be associated with this finding (Table 3). Among the participants confirming their intensified interest, there were also significantly fewer women not dealing with the topic of breast cancer at all (44.6% for "no, not influenced by the media coverage" vs 35.4% for "yes, influenced by the media coverage"; OR, 0.680 [$P = .003$]), and this subset of participants was also more likely to do so because of a friend being affected by the disease (33.9% for "no, not influenced by the media coverage" vs 46.9% for "yes, influenced by the media coverage"; OR, 1.718 [$P = .003$]) (Table 3).

In question H ("In the case of reconstruction of the breast, would you generally prefer.?"), the majority of participants in poll 2 preferred autologous breast reconstruction (662 women; 66.2%) over implant-based reconstruction (82 women; 8.2%), with the remainder indicating they did not know (256 women; 25.6%). Replying "do not know" was not found to be associated with any type of answer to question G ("Has the related media coverage made you deal more intensively with the topic of breast cancer?"). Poll 2 participants who answered "yes, the related media coverage made me deal more intensively with the topic of breast cancer" in question G were 2.4 times more likely to select implant-based reconstruction (30 of 160 women; 18.8%) compared with those who indicated "no" (52 of 584 women; 8.9%) (OR, 2.4; $P = .00057$).

DISCUSSION

To our knowledge, the current study is the first to prospectively measure a positive media-related effect on

TABLE 2. Stratification Variables and Polls

Stratification Variables		Poll 1	Poll 2	*P*
Age, y	18-29	231	233	.91
	30-49	472	464	
	50-59	195	201	
	60-65	102	102	
Education	Minimum required educational level	157	217	2.5e-09
	Completed professional training/mid-level school	429	467	
	High school graduate	200	219	
	College or university degree	214	97	
Profession	Freelance/senior executive	124	95	1.7e-08
	Employed/public officer	394	396	
	Laborer/farmer/technician	191	114	
	No occupation	291	395	
No. of inhabitants	<5000	402	433	.011
	<50,000	228	247	
	>50,000	82	106	
	Vienna (1.74 million)	288	214	
Marital status	Single	314	224	3e-05
	Married/civil union	561	618	
	Divorced/separated	95	108	
	Widowed	30	50	
Net income, Euros	<1200	96	86	.78
	1201-1500	84	87	
	1501-2000	106	125	
	2001-2500	125	120	
	2500-3000	131	125	
	>3000	211	197	
	NA	247	260	
No. of individuals per household	1	158	158	0.61
	2	289	292	
	3	239	211	
	4	200	218	
	5	76	70	
	6	28	38	
	>6	10	13	
No. of children per household	0	702	637	.019
	1	162	150	
	2	101	153	
	3	24	43	
	4	6	12	
	>4	5	5	

Abbreviation: NA, not applicable.

public awareness after a celebrity announcement regarding breast reconstruction.

To our knowledge, only a few publications to date have highlighted the media-related impact on the health care sector, notably breast cancer. Two retrospective studies, one from Canada[15] and one from the United Kingdom,[11] demonstrated that referral rates for breast cancer were influenced by the media-related publication of Ms. Jolie's prophylactic bilateral mastectomy in May 2013. In the Canadian study, a 90% increase among women correctly referred for breast cancer genetic counseling after media reports was observed.[15] In the UK study, the referrals more than doubled after Ms. Jolie's announcement, and remained at this level for at least 6 months thereafter.[11] We found that the media-related effect triggered awareness regardless of the level of personal involvement of the participants. As the results demonstrate, approximately 20% of participants in the second poll were affected by media coverage of Ms. Jolie's mastectomy in the same way as they would be in the case of a friend. This finding is supported by a theory by Reeves and Nass,[16] which suggests that individuals tend to treat computer-related, television-related, and other media-related experiences as if they were self-observed or actually occurring experiences.

Participants were aware that reconstruction was a viable option after breast cancer, but even less was known regarding autologous or simultaneous options - therapeutic alternatives readily offered in interdisciplinary settings. This finding nicely demonstrated the public's awareness, which is different from patients actually affected by the disease. The choice of the type of breast reconstruction

TABLE 3. Answer to Question G: "Has the Related Media Coverage (of Angelina Jolie) Made You Deal More Intensively With the Topic of "Breast Cancer"?: Association With Other Questions

	"Has the Related Media Coverage (of Angelina Jolie) Made You Deal More Intensively With the Topic of "Breast Cancer"? Association With Other Questions	Yes (205 of 1000 Women), %	No (795 of 1000 Women), %	*P*	OR
A	Have you ever been operated on your breast(s)?	6.4	9.5	.071	1.5324
B	Have you ever had to look into the topic of breast cancer in relation to yourself or a close relative?				
B_1	Yes, myself	4.6	6.8	.13	1.5178
B_2	Yes, a friend	33.9	46.9	3e-05	1.718
B_3	Yes, a relative	21.9	19.6	.39	0.873
B_4	No	44.6	35.4	.003	0.680
C	Do you know that it is possible to reconstruct the breast(s) after removal of one or both breasts in the context of breast cancer treatment?	91.4	94.4	.066	1.580
D	Do you know that breast reconstruction is possible by the use of silicone implants?	90.5	87.0	.079	0.703
E	Do you know that breast reconstruction is possible by the use of your body's own tissue?	68.5	65.4	.29	0.867
F	Do you know that in case of a surgical removal of the affected breast, it is possible to simultaneously reconstruct this breast in the same operative session?	57.0	61.9	.12	1.224

Abbreviation: OR, odds ratio.

performed is influenced predominantly by the referring surgeon[17] and by the involvement of plastic surgeons in the decision-making process.[18-21] Although we were able to demonstrate that media information positively affected public opinion, the lack of information regarding the therapeutic options does not only apply to the general public but also to medical graduates. Recent studies have revealed poor knowledge of the actual role of plastic surgeons and the procedures offered by the specialty.[22-24]

Another indicator of the varying degrees of information and perception among the general public was that our polling results (66.2% would choose autologous tissue reconstruction, 8.2% would choose implants, and 25.6% replied "don't know") reflect an opposing trend to the increase in implant-based breast reconstruction in the United States (reported implant reconstruction rates of 70%[25] or 61%[26]) or the United Kingdom's rate of 37%.[26] Approximately 20% of participants in poll 2 were subjectively influenced in their thinking about breast cancer by news coverage of Ms. Jolie's announcement, and among those influenced we observed higher odds for selecting implant-based reconstruction. Although the majority of participants in poll 2 preferred reconstruction using autologous tissue, this does not necessarily indicate that their individual decision for a hypothetical treatment option would also be affected in the same way. In the case of Ms. Jolie, the media-related interest was centered on breast cancer-related genetics, and less so on breast reconstruction after a prophylactic mastectomy. Breast reconstruction is an integral part of breast cancer treatment and has a positive influence on patient satisfaction as well as quality of life after breast cancer survival.[27] For cancer specialists, it is helpful to be aware of public opinion when consulting patients with breast cancer. Actively involving patients and offering all suitable options (including breast reconstruction) in the decision-making process was reported to significantly enhance satisfaction with the overall treatment of breast cancer.[28,29]

Strengths of the current study were its prospective nature, the timing of the polls (before and after Ms. Jolie's announcement), and the population-matched span. Another advantage was the recruitment of 2 different collective samples in both polls, thereby avoiding the effect of the first group from the initial survey being "trained for the second poll." Limitations of the current study include the use of an online panel selection, and the format of the survey among a preselected collective of the general public.

The current study results indicate that it is important and feasible to obtain a snapshot of the general public's awareness and the media-related influence on health care-related issues. Individual choice will become a driving force for patient-centered decision-making[30] and interactive methods for collecting these types of data[31] will play a dynamic role in shaping the future of medicine. From a serendipitous point of view, the current study was the result of a lucky coincidence, which enabled us to demonstrate a prospective media-related effect of breast

cancer treatment awareness in the female general public for the first time.

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