

E-Coaching: the DianaWeb study to prevent breast cancer recurrences

V. Gianfredi^{1,2}, D. Nucci³, M. Balzarini⁴, M. Acito¹, M. Moretti¹, A. Villarini⁵, M. Villarini¹

¹ Department of Pharmaceutical Sciences, University of Perugia, Perugia; ² Post-Graduate School of Hygiene and Preventive Medicine, Department of Experimental Medicine, University of Perugia, Perugia; ³ Digestive Endoscopy Unit, Veneto Institute of Oncology IOV - IRCCS, Padua; ⁴ It's Informatica e Comunicazione, Brescia; ⁵ Department of Preventive and Predictive Medicine, Fondazione IRCCS Istituto Nazionale dei Tumori, Milan, Italy

Abstract

Introduction. Breast cancer is the most common cancer in women worldwide, for which the survival rate is increasing over time. Growing evidence are showing that the effect of lifestyle could have the same weight of the effect of the usual clinical-pathological risk factors on survival rate. The DianaWeb study responds to the pressing request of patients diagnosed with breast cancer to know the most advanced point of scientific research on the prevention of recurrences, to have a virtual space to meet, where to receive advice and practical information for the daily management the lifestyle change. DianaWeb is a community-based participatory research, dedicated to breast cancer patients, aimed to monitor lifestyle, provide them tips to encourage sustainable lifestyle changes, and to analyze clinical outcomes. In order to achieve these aims, DianaWeb uses a specific interactive website (<http://www.dianaweb.org/>).

Methods. The web architecture has been designed essential and light, with a rigorous implantation that brings the figure of the woman to the center. In order to humanized the project the acronym used to identify the study was Diana (Diet and Androgens), a classical female name, who was illustrated as a female avatar, aimed to symbolize all women. The graphical interface was developed using seven pastel tones colors, which become a fundamental elements of the layout, such as frame, navigation menu, and separation interspaces.

Results. The project started in 2015, and in 4 days the web site was visited by more than 1000 people. A total of 2823 persons enrolled in the study, but 2182 did not send the full documentations, 61 persons abandoned the study, 641 timely answered to the questionnaires.

Conclusions. The high number of participants' interaction within the web page, confirmed the high usability of the web page and the great interest of patients. Prevention of breast cancer recurrences with low cost technologies, easily available to everybody, is a priority for both public health and public finances. *Clin Ter 2020; 171(1):e59-65. doi:10.7417/CT.2020.2190*

Key words: Breast cancer neoplasm, prevention, recurrences, Italy, web site

Introduction

Breast cancer (BC) is the most common cancer in women worldwide, and it is increasing in countries with low and middle incomes. The International Agency for Research on Cancer (IARC) estimated a number of 522,000 incident cases per year in Europe, more than colorectal cancer (499,000), prostate cancer (449,000) and lung cancer (470,000)(1). BC is one of a few cancers for which there are screening program. The introduction of mammography screening program, has determined a significant and stable decrease in the incidence of late-stage breast cancer(2). Actually, there are evidence concerning the efficacy of screening for breast cancer and colorectal cancer, derived from randomized trials, and for cervical cancer, derived from observational studies(3). Due to the technology advancement, increasing knowledge on risks factors and preventive measures, and the broad adherence to cancer screening programs, BC patients' survival increased in the last decades. EUROCORE-5 project estimated that European BC patients' 5-year relative survival (i.e. survival in absence of non-BC deaths) was 82% for patients diagnosed in 2000-2007 (4). Investigating whether lifestyle factors affect BC patients' survival is a relatively new area of research, in fact, growing evidences show that the effect of lifestyle could have the same weight of the effect of the usual clinical-pathological risk factors (TNM classification, hormonal receptors expression, Ki67) (5, 6).

Among the already known risk factors, obesity and metabolic syndrome are strictly related to unhealthy lifestyle, such as diet and physical inactivity. In particular, obesity is an independent risk factor for postmenopausal BC and specifically, for estrogen receptor (ER)-positive/progesterone receptor (PR)-positive BC. Moreover, obesity is associated with worse prognosis, both before and after menopause(7). Whilst, metabolic syndrome is associated with increased risk of BC in postmenopausal women(8), and with BC recurrences in patients diagnosed both before and after menopause (9). All these factors can be favorably modified by adopting a diet inspired to the traditional Mediterranean Diet and to the European Code Against Cancer (ECAC), the

Correspondence: Vincenza Gianfredi, Post-Graduate School of Hygiene and Preventive Medicine, Department of Experimental Medicine, University of Perugia, Piazzale Gambuli 1, 06132. Perugia, Italy. vincenza.gianfredi@studenti.unipg.it tel 0755857488

latter including recommendations on diet and on physical exercise of moderate intensity. The analysis of prospective cohort studies suggested that a high score of adherence to the ECAC is associated with 30-50% lower incidence of BC (10, 11), and several studies have suggested a decrease of BC recurrence and death in patients who exercise at least 30 min /day (12-14). Although these preventive measures are inexpensive and largely beneficial, this information is not currently available to patients and are not yet included in oncology protocols. With a few exceptions, physicians are not aware of these scientific results and are not yet culturally prepared for life-style prescriptions. This gap in knowledge cannot be further accepted in a context in which technological development and wide spread of internet count for a worldwide 4,208,571,287 internet users(15). In some countries or continent, there are a 90% of regular users upon the total population, in Italy, approximately 65% of population regularly use the Internet, and 57% of them use the web for searching health-related information(16). On one hand the wide and rapid internet dissemination, makes available an enormous quantity of news and information also related to health, however, on the other hand, the easy but uncontrolled web access, had also determined a serious and important risk of misinformation. For this reason, we implemented the DianaWeb study, a community-based participatory research (CBPR) (17), that offers to BC patients a specific interactive website where patients can find evidence based recommendations and tips for sustaining life-style changes.

The aim of this paper is to present data on DianaWeb internet platform development and preliminary results of participants' activities within the web page.

Methods

The study protocol was previously detailed (18). Briefly, patients are recruited on a voluntary basis and, after having signed an informed consensus form, they are enrolled in the study. Once registered, patients fill in: 1) anthropometry form, 2) medical history questionnaire, 3) 24 hours recall containing a list of 65 food items and 5 questions concerning physical activity, 4) a short and previously validated questionnaire on Mediterranean diet adherence (MEDAS)(19); and 5) the latest results of specific blood tests (glycaemia, cholesterol tot, HDL-C, LDL-C, triglycerides, CRP, liver tests, plasma albumin, vitamin D, insulin and testosterone). Furthermore, as social and convivial aspects are crucial in this project, meetings and conferences concerning the latest evidence-based recommendations for a healthy life-style and walking groups are simultaneously organized by the staff, who actively participates in these activities, as well. Moreover, several kitchen classes are also organized, where participants learn how to cook vegetables, pulses, seeds and whole grain cereals.

Web page development

The DianaWeb study developed an *ad hoc* internet platform by which a cohort of women with BC, regardless of stage and time of diagnosis, can be created. Therefore, the

recruitment is performed publicizing the web page by which the participants, who agree to join the project, could voluntarily register on the website: <http://www.dianaweb.org/>.

The web site is composed of two main areas; the first one is completely open, while the second is restricted only to included subjects. The first area is composed by the home page, containing a brief presentation of the project aim and modalities on how to participate; further, also evidence-based and updated health related information concerning major modifiable risk factors effecting the progression of BC and metastatic diffusion, and how to prevent BC recurrences and to improve prognosis are provided. The restricted area is accessible only with patient ID and PW. In this area the patient inserts their clinical [TMN, grading, receptor (ER, PGR, ErbB2), p53, Ki67, date of the first surgery, type of treatment, date and type of recurrences], anthropometric, life style behaviors (diet and physical activity) and routinely blood test results. These data were required at the enrolment stage and dietary habits and physical exercise data were collected every 3 months, through a 24 hours recall. Then, every 12 months, we ask all the women recruited whether any changes in their health status occurred in the previous months. Each year, an alert reminds the patients to fill in all the forms in case of missing information (anthropometry and clinical chemistry data update). All the reminders are sent by e-mail generated automatically by the web page. Moreover, if some entered alarming data (for instance high alcohol intake, low level of physical activity or high level of blood pressure) automatic alerts are sent to the participants, providing medical advices or inviting them to contact their physician.

Hence, the aims of DianaWeb interactive website were to: i) provide evidence-based information; ii) store individual information on participants' measurements, protected and accessible only to researchers; iii) provide a section where women can directly contact a pool of specialists (nutritionists, medical doctors, biologists, administrator or exercise specialists) in order to put specific questions or proposals; iv) develop the FAQ (frequently asked question) section.

Statistical analysis

Data were downloaded from the website in Excel Microsoft © format and analyzed using STATA/SE. Absolute number and percentage are reported where appropriate. Data presented in this paper are updated at the date of 31st December 2018.

Results

The Web site

The web architecture has been designed essential and light, with a rigorous implantation that brings the figure of the woman to the center. In order to humanize the project the acronym used to identify the study was Diana (Diet and Androgens), a classical female name. Diana is illustrated as a female avatar, and her imagine aims to symbolize all women, but at the same time also the guardian, mentor and guide within the project. Diana is present in all web pages,

for accompanying the users and explaining how to manage all the steps of the project. Seven pastel tones colors represent the chromatic scale, becoming a fundamental element of the layout, such as frame, navigation menu, and separation interspaces, as reported in Figure 1. The printing type used is the NEXA family, in light, normal, and bold versions. The graphic interface has been designed considering the public side and all its variations in the functionality of the private sections. An example of the graphical web interface is reported in Figure 2A and 2B.

Statistics of the website access and usability

The project started in January 2015, and the web accesses performed during the first 4 days, following the web site launch, were 1007. The temporal distribution of activities performed by the participants is reported in Figure 3 showing an annually decrement of new enrollment and simultaneously an increment of activated participants, as expected (Values are reported in Table 1). Thanks to the very high number of annually access, in total a 2823 persons enrolled in the study, but 2182 did not send the full documentations, 61 persons abandoned the study, 641 timely answered to

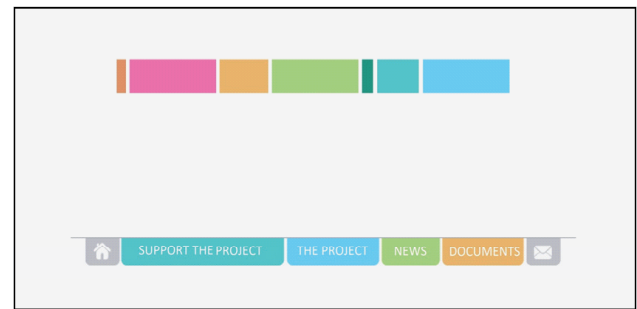
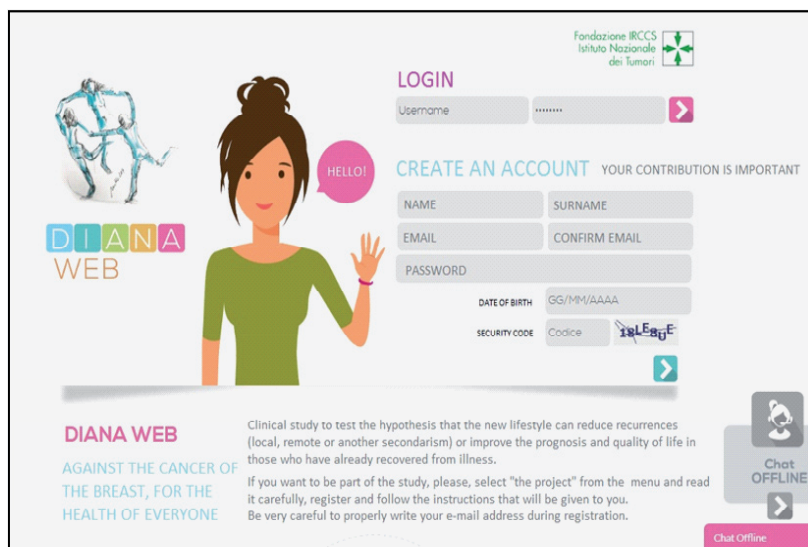
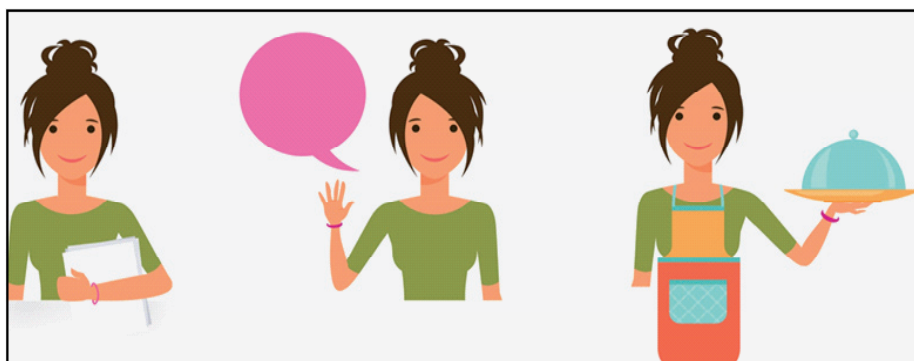


Fig. 1. Example of different use of seven pastel tones colors.

the questionnaires. The mean age of active subjects is 54 years (range 34-80 years). Considering the educational level, the majority of participants are highly educated (47.6% graduated and 44.8% with high school diploma), while less than 10% had a low level of instruction (7.2% middle school and 0.4% elementary). The e-mails sent allowed to achieve 3354 anthropometric charts filled, 907 anamnestic profiles, 3145 hematological examinations uploaded, 11068 food-frequency questionnaires completed, and 6035 surveys on life-style (Table 2).



A



B

Fig. 2. Example of graphical interface of the web site

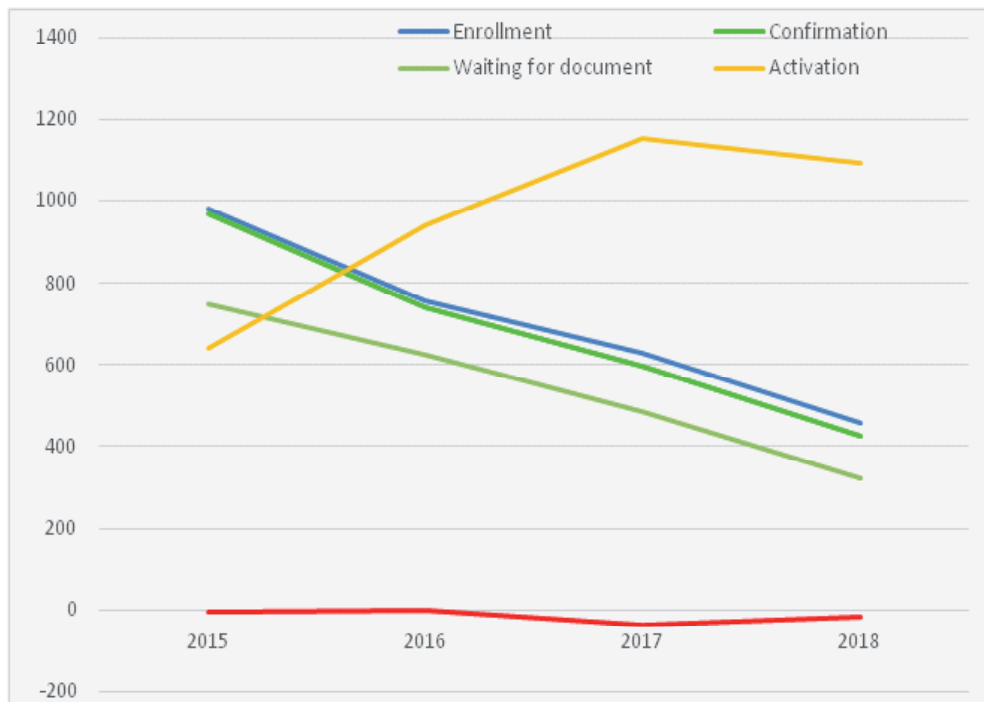


Fig. 3. Temporal trend of participants' activities within the project.

Table 1. Number of participants' activities within the project, 2015-2018.

	2015	2016	2017	2018
Enrollment	979	758	630	456
Confirmation	967	740	596	427
Waiting for document	748	624	487	323
Activation	642	938	1150	1092
Drop out	-6	-2	-37	-16

Table 2. Characteristics of the participants and number of filled charts.

Characteristics of the sample	% of participants
Age (mean and range) years	54 (34-80)
Sex	100%
Educational level	
Graduated	47.6
High school	44.8
Middle school	7.2
Elementary school	0.4
	Number
Filled Charts	
Anthropometric charts	3354
Anamnestic profiles	907
Hematological examinations	3145
Food frequency questionnaires	11068
Life-style questionnaires	6035

Discussion

In literature, there are several examples highlighting the need to bridge the gap between BC patients' knowledge and scientific evidence. Coons and colleagues showed that 92% of neoplastic patients feel the need to talk with their doctor about the disease and its management, but only 58% of these actually had a comparison at the beginning of the diagnosis(20). Also useful is the example of the blog on the "D la Repubblica" website that gives voice to women with BC in order to share their experiences of life and illness. Some of the treated topics are: "the relationship with the physicians and with the healthcare" and "the daily life"(21). The qualitative longitudinal study, carried out in 2014 by Thorne, has shown that women with BC, who return in everyday life after the treatment period, live a condition of confusion and anxiety resulting from the inability to manage symptoms and to prevent and recognize recurrences. They also required clarification on how to plan follow-up

and how to be responsible for preserving their health(22). In particular, the neoplastic patients' information need is primarily filled by consulting a physician, followed by internet search and thirdly by media(23). According to a recent review, the most frequent topics searched are those related to prognosis, followed by treatment, general cancer information and lastly psychological support(23). For these reasons, institutions and research organizations should improve the communication and dissemination of scientifically valid information, even within the web. The most important components for a high quality website are clarity and comprehensibility of contents, and the easily usability for users(24). Indeed, the design of a website is one of the most important indicators of the credibility and quality of the website (25). An appreciates website is able to have greater visibility, send useful messages, grasp users' needs, and receive feedback on the satisfaction and usefulness of the service. These results might be achieved thanks to characteristics such as: frequent update of the information, universal connectivity, low costs and interactivity (26). In particular, websites should be easy to access, in order to intuitively find all the useful information(27). In this regard, the recent work of Tao et al. highlighted five basic features for a website containing health information: completeness, comprehensibility, relevance, degree of detail and accuracy of information (27).

The DianaWeb study responds to the pressing request of patients diagnosed with BC to know the most advanced point of scientific research on the prevention of recurrences, to have a virtual space to meet, where to receive advice and practical information for the daily management the lifestyle change (28). The high number of questionnaires and charts filled, confirmed the high usability of the web page and the great interest of patients. Diana web page can be effectively used to increase access to accurate information and the internet platform allow to recruit a large number of participants, to monitor participants' life-style and health status over time in a very inexpensive way. Preliminary results on lifestyle, characteristics of the enrolled patients, and adherence to World Cancer Research Found recommendations, were published elsewhere (29). Furthermore, the validity and accuracy of data self-reported by patients in DianaWeb study has been confirmed (30).

The use of the Diana figure, as an avatar, aims to create empathy with the target and impress the project in memory. At the same time, Diana guides step-by-step the participants along the study phases. Further, the cordial but clear e-mail notifications, reminds the activities of the project. We choose participatory web-site approach and cooking classes interacted by chef and nutritionist because participatory approach develop a feedback useful for both women and researchers, and because there is a growing evidence result for internet based interaction and social support. According to a recent review of the literature, subjects with greater knowledge of food and culinary practices have shown to follow healthier dietary practices and to consume a higher variety of fruit and vegetables (31).

Limits and strengths

Even if the web interface greatly increase the connection with a higher number of participants, it could also increase the dropout rates of participants. Moreover, although automatic messages are send to improve the response rate, the information are collected through questionnaires, entirely depending on the respondent's cooperation. Lastly, the use of email address might reduce the study participation to the only equipped subjects. However, there are no reasons to suspect a potential bias that might affect the results. Moreover, our study has some important strengths, first it is a community-based participatory study, second the web interface allows a wide spread of the project, as well as a continuous interaction with the participants. Thirdly, the web page is a cheap and versatile tool able to timely provide updated knowledge. Lastly, the web platform consents to participants to directly upload data, reducing the paper-based information. Future steps of this project are to increase the number of participants, and to verify if offering tips and recommendations through an interactive website is able to sustain participants' life-style changes.

In conclusion, the DianaWeb project aims to close the so-called know-do gap through an interactive web page, and assigning a more central role to users in order to improve users' knowledge and skills(32, 33). Prevention of BC recurrences with low cost technologies, easily available to everybody, is a priority for both public health and public finances. Offering high-quality evidence-based preventive information to BC patients, we will avoid the risk that they become prey of "alternative" medicines that may induce them to decline evidence based treatments. Generally, the current literature suggests that older adults are slower to adopt new technologies (specifically computers and internet) than younger adults(34), for this it is important to make technology more age-friendly. Furthermore, the use of the internet-based intervention allows a continuous health-support, reducing the time span usually present between two or more face-to-face visits.

Ethics

DianaWeb is a voluntary base study, that does not interfere with prescribed oncological treatments. The DianaWeb study has received ethical approval from the local ethics Committee of the Fondazione IRCCS Istituto Nazionale dei Tumori di Milano, Protocollo INT 24/16 (27 luglio 2016).

Acknowledgements

The authors would like to thank all participants who voluntarily participated in the study and all the members of It's team.

Funding

This work was supported by "Lega Vita e Salute onlus".

Competing interests: none

References

1. International Agency for Research on Cancer. World Cancer Report. In: Wild CP, Weiderpass E, Stewart BW, editors. 2018
2. Foca F, Mancini S, Bucchi L, et al. Decreasing incidence of late-stage breast cancer after the introduction of organized mammography screening in Italy. *Cancer*. 2013; 119(11):2022-8
3. Paci E, Group EW. Summary of the evidence of breast cancer service screening outcomes in Europe and first estimate of the benefit and harm balance sheet. *Journal of medical screening*. 2012; 19 Suppl 1:5-13
4. De Angelis R, Sant M, Coleman MP, et al. Cancer survival in Europe 1999-2007 by country and age: results of EURO-CARE--5-a population-based study. *Lancet Oncol*. 2014; 15(1):23-34
5. Kamranzadeh H, Ardekani RM, Kasaieian A, et al. Association between Ki-67 expression and clinicopathological features in prognosis of breast cancer: A retrospective cohort study. *J Res Med Sci*. 2019; 24:30
6. Ghose A, Kundu R, Toumeh A, et al. A review of obesity, insulin resistance, and the role of exercise in breast cancer patients. *Nutr Cancer*. 2015; 67(2):197-202
7. Engin A. Obesity-associated Breast Cancer: Analysis of risk factors. *Adv Exp Med Biol*. 2017; 960:571-606
8. Wani B, Aziz SA, Ganaie MA, et al. Metabolic Syndrome and Breast Cancer Risk. *Indian J Med Paediatr Oncol*. 2017;38(4):434-9
9. Berrino F, Villarini A, Traina A, et al. Metabolic syndrome and breast cancer prognosis. *Breast cancer research and treatment*. 2014;147(1):159-65
10. Romaguera D, Vergnaud AC, Peeters PH, et al. Is concordance with World Cancer Research Fund/American Institute for Cancer Research guidelines for cancer prevention related to subsequent risk of cancer? Results from the EPIC study. *The American journal of clinical nutrition*. 2012; 96(1):150-63
11. Hastert TA, Beresford SA, Patterson RE, et al. Adherence to WCRF/AICR cancer prevention recommendations and risk of postmenopausal breast cancer. *Cancer epidemiology, biomarkers & prevention : a publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology*. 2013; 22(9):1498-508
12. Holick CN, Newcomb PA, Trentham-Dietz A, et al. Physical activity and survival after diagnosis of invasive breast cancer. *Cancer epidemiology, biomarkers & prevention : a publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology*. 2008;17(2):379-86
13. Holmes MD, Chen WY, Hankinson SE, et al. Physical activity's impact on the association of fat and fiber intake with survival after breast cancer. *American journal of epidemiology*. 2009; 170(10):1250-6
14. Zhong S, Jiang T, Ma T, et al. Association between physical activity and mortality in breast cancer: a meta-analysis of cohort studies. *European journal of epidemiology*. 2014; 29(6):391-404
15. Internet World stats. Internet usage statistics 2018 [updated 30th June 2018. Available from: <https://www.internetworldstats.com/stats.htm>.
16. Siliquini R, Ceruti M, Lovato E, et al. Surfing the internet for health information: an italian survey on use and population choices. *BMC medical informatics and decision making*. 2011; 11:21
17. Minkler M, Wallerstein N. Community-based participatory research for health: From process to outcomes. 2nd ed2010.
18. Villarini M, Lanari C, Nucci D, et al. Community-based participatory research to improve life quality and clinical outcomes of patients with breast cancer (DianaWeb in Umbria pilot study). *BMJ open*. 2016; 6(6):e009707
19. Schroder H, Mendez MA, Ribas-Barba L, et al. Mediterranean diet and waist circumference in a representative national sample of young Spaniards. *International journal of pediatric obesity: IJPO: an official journal of the International Association for the Study of Obesity*. 2010; 5(6):516-9
20. Coons HL, Sampayo I, Harmer V, et al. Make your dialogue count survey: addressing communication gaps between patients with advanced breast cancer, their caregivers and oncologists and understanding information and emotional needs to improve treatment and side effect management. *The Breast*. 2015; 24(S3):S36
21. Balena F, Moriconi T, Vacca I, et al. "Fight, live, keep smiling": The first italian blog about metastatic breast cancer (MBC) addressed to the generalpublic. A quali-quantitative analysis of all the comments posted online on the blog of the europa donna italia MBC working group. *The Breast*. 2015; 24(S3):S36-S7
22. Thorne S, Hislop TG, Kim-Sing C, et al. Changing communication needs and preferences across the cancer care trajectory: insights from the patient perspective. *Supportive care in cancer : official journal of the Multinational Association of Supportive Care in Cancer*. 2014; 22(4):1009-15
23. Jo HS, Park K, Jung SM. A scoping review of consumer needs for cancer information. *Patient education and counseling*. 2019
24. Lee K, Hoti K, Hughes JD, et al. Consumer Use of "Dr Google": A Survey on Health Information-Seeking Behaviors and Navigational Needs. *Journal of medical Internet research*. 2015; 17(12):e288
25. Agree EM, King AC, Castro CM, et al. "It's got to be on this page": age and cognitive style in a study of online health information seeking. *Journal of medical Internet research*. 2015; 17(3):e79
26. Kotsenas AL, Arce M, Aase L, Timimi FK, Young C, Wald JT. The Strategic Imperative for the Use of Social Media in Health Care. *Journal of the American College of Radiology: JACR*. 2017
27. Tao D, LeRouge C, Smith KJ, et al. Defining Information Quality Into Health Websites: A Conceptual Framework of Health Website Information Quality for Educated Young Adults. *JMIR human factors*. 2017; 4(4):e25
28. Villarini A, Villarini M, Gargano G, et al. [DianaWeb: a demonstration project to improve breast cancer prognosis through lifestyles]. *Epidemiologia e prevenzione*. 2015; 39(5-6):402-5
29. Gianfredi V, Villarini M, Lanari C, et al. DianaWeb: esempio di ricerca partecipata attraverso Internet per lo studio dell'effetto dello stile di vita sulla prognosi del tumore al seno. *Dati preliminari. Not Ist Super Sanità*. 2016; 29(5):i-ii
30. Villarini M, Acito M, Gianfredi V, et al. Validity of self-reported anthropometric measures and derived body mass index in a sub-cohort of the DianaWeb population study. *Clinical Breast Cancer*. 2019;In press
31. Vaitkeviciute R, Ball LE, Harris N. The relationship between food literacy and dietary intake in adolescents: a systematic review. *Public health nutrition*. 2015;18(4):649-58
32. van den Driessen Mareeuw F, Vaandrager L, Klerkx L, et al. Beyond bridging the know-do gap: a qualitative study

- of systemic interaction to foster knowledge exchange in the public health sector in The Netherlands. *BMC public health*. 2015; 15(1):922
33. Gianfredi V, Grisci C, Nucci D, et al. [Communication in health.]. *Recenti progressi in medicina*. 2018;109(7):374-83
 34. Czaja SJ, Charness N, Fisk AD, et al. Factors predicting the use of technology: findings from the Center for Research and Education on Aging and Technology Enhancement (CREATE). *Psychology and aging*. 2006; 21(2):333-52