BOUNCE

Predicting Effective Adaptation to Breast Cancer to Help Women to

BOUNCE Back

BOUNCE NEWSLETTER

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THE **BOUNCE** PROJECT AT A GLANCE: MEETING THE CHALLENGE OF A MULTINATIONAL PROSPECTIVE STUDY ON RESILIENCE

By Dr **Paula Poikonen-Saksela**, MD, PhD
Helsinki University Hospital Comprehensive Cancer Center, Helsinki, Finland, BOUNCE Project Coordinator

Coping with breast cancer is a major challenge. Thus, it is necessary for health professionals to help patients increase their psychological resilience toward better and faster recovery.

The BOUNCE project will explore the factors that influence breast cancer patients' resilience and their ability to resume a normal everyday life through cost-efficient clinical tools for patient empowerment.

BOUNCE develops and deploys advanced computational tools to validate indices of patients' capacity to bounce back during the highly stressful treatment and recovery period following diagnosis of breast cancer. Elements of a dynamic, predictive model of patient outcomes are incorporated in building a decision-support system to be used in routine clinical practice providing oncologists and other health professionals with concrete, personalized recommendations regarding optimal psychosocial support strategies.

BOUNCE AND THE FORGOTTEN GENERATION: ADULT CHILDREN OF MOTHERS WITH BREAST CANCER

By the HUJI Dissemination team

The diagnosis and treatment of a mother with cancer has ripple effects on the entire family system. Although the impact of the diagnosis and treatment on the status of the relationship between the wife and husband have been well studied, how adult children are affected has received much less attention. In a study focusing on the topic of adult children of patients with breast cancer, it was shown that mothers with breast cancer and their adult daughters very often experience similar levels of psychological as well as physiological distress. Stress hormone secretions and immune function of daughters are related to both their own and to their mothers' psychological distress.

In addition, a literature review on the topic concluded that clinicians often fail to consider daughters. Yet adult children can be important sources of support and their own adjustment to the illness may directly affect the mental health of their mother. The study concluded that a holistic approach to providing support and enhancing resilience in breast cancer patients should include all members of the family. Moreover, the quality of support provided by family members and its effect on women's mental health varies among racial/ethnic groups, suggesting the importance of culturally sensitive provision of care by clinicians. An insightful hands-on guide of how women with breast cancer can communicate with their families can be found in the following websites:

- https://patientpower.info/navigating-cancer/care-partners/communicating-cancer-to-adult-children
- https://www.cancerresearchuk.org/about-cancer/cancer-chat/thread/when-to-tell-my-adult-children

The corona pandemic has created a new reality in terms of patient care delivery in all fields and more specifically in breast cancer care. The support that family and adult children can provide during social isolation may be a venue to increase wellbeing and develop resilience for patients and their families. Our readers will find useful tips and expert guidelines in the following CME course:

https://www.e-eso.net/sessions.do?methodcall=details&idegrandround=1832&Ticket=

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THE HUS PATIENT SUPPORT DIGITAL PLATFORM BECOMES FULLY OPERATIONAL

By **Paula Poikonen-Saksela** MD, PhD, Helsinki University Hospital Comprehensive Cancer Center, Helsinki, Finland, BOUNCE Project Coordinator

We are happy to announce that the BOUNCE intervention pilot study is underway with the first patient enrolled at the HUS Comprehensive Cancer Centre in December 2020. The aim of this study is to test the workflow of the resilience predictor tool in clinical practice and provide valuable information regarding patient acceptance of and compliance with digital interventions.

The interventions available for the purposes of this preliminary study comprise psychosocial support (as illustrated in Figure 1), exercise (see Figure 2) and nutrition guidance to avoid weight gain during and after breast cancer treatments (a sample page is shown in Figure 3). All the interventions are offered digitally within the HUS **Health Village My Path** platform. This platform was designed to enable sharing of information among patients and to provide guidance, and has been used clinically since 2016. The BOUNCE project was an excellent opportunity to upgrade the digital services, incorporate a data-driven prediction support tool and conduct a full-scale efficacy study.

Before starting this study, the digital intervention path in HUS Health Village was evaluated by three patient representatives who provided valuable feedback about the usability and contents of the platform. Both aspects of the platform received a very positive overall evaluation, and relatively minor technical improvements and changes in the wording were suggested and implemented. The need to provide online technical support, especially for beginner users, was also recognized.

The majority of women who were asked to participate during these first weeks expressed interest and 24 patients provided consent. Some patients expressed concerns for not having the technical skills to use the platform, only to find out that basic ability to navigate through the internet is sufficient.

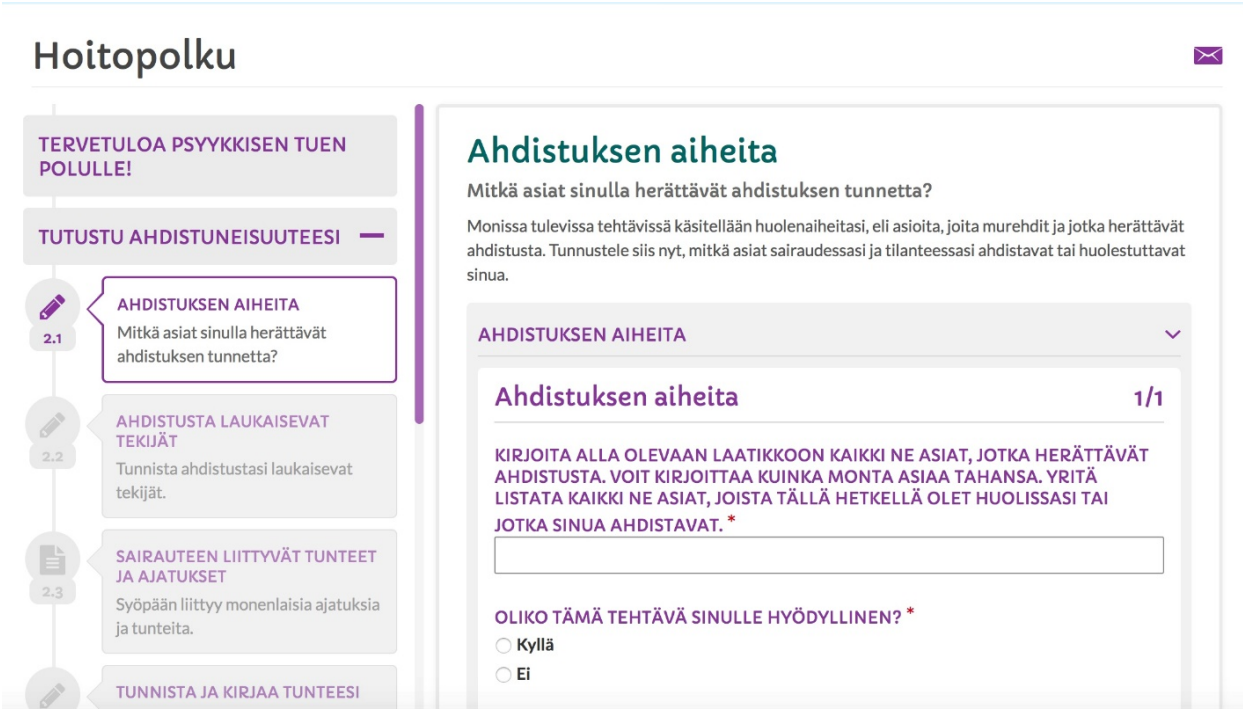

Figure 1

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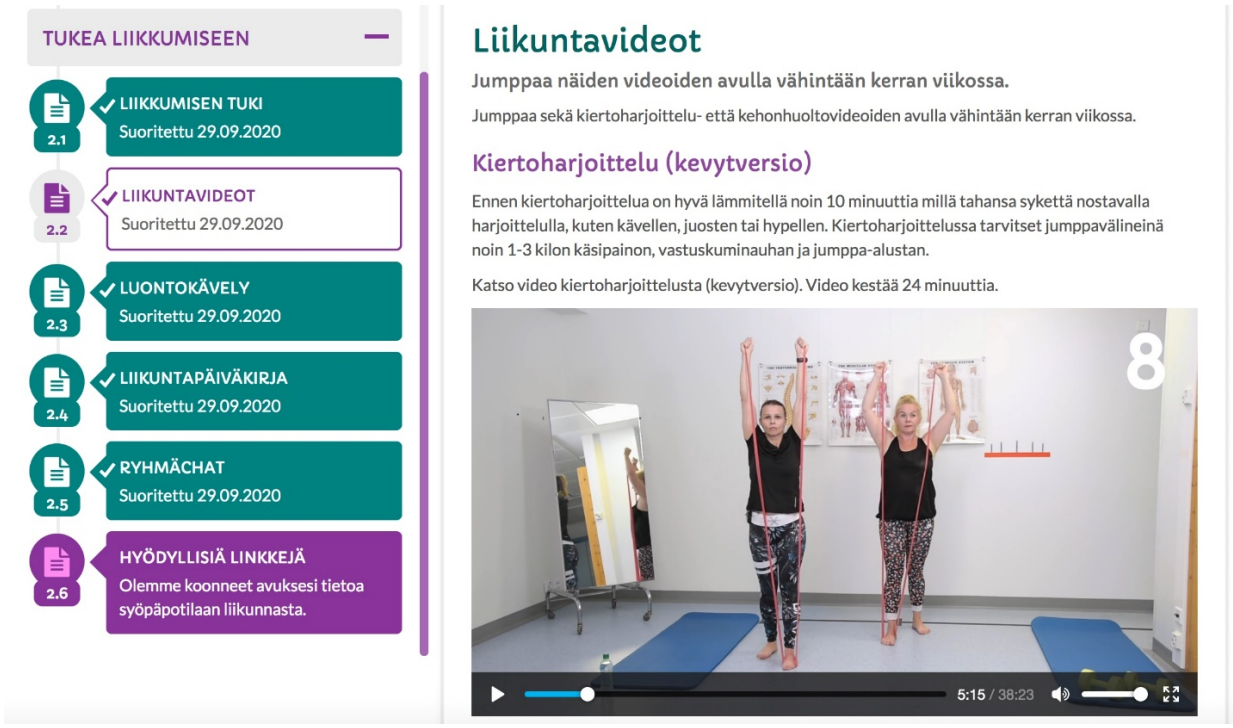

Figure 2

Figure 3

PSYCHOSOCIAL PROFILES OF RESILIENCE IN THE ERA OF PERSONALIZED MEDICINE

By **Giorgos Manikis** MSc, **Konstantina Kourou** PhD, and **Evangelos Karadimas** PhD, Computational Bio-Medicine Laboratory, Institute of Computer Science, Foundation for Research and Technology-Hellas, Heraklion, Greece.

With advances in data science, new meaningful insights can be obtained from large biomedical datasets towards helping clinicians improve breast cancer management and tailor medical treatments to the individual profiles of each patient. Recently, the use of data mining tools and applied machine learning is growing over conventional statistical approaches to achieve more accurate predictions

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regarding clinically significant threats to the well-being of cancer patients. The BOUNCE project takes these efforts one step further by developing Machine Learning tools to improve understanding and to predict the psychosocial resilience of women with breast cancer throughout the disease continuum.

Machine Learning (ML), a branch of Artificial Intelligence, relates the problem of learning from available data to the general concept of inference. Every learning problem consists of two phases: (i) the estimation of unknown dependencies within a given dataset and (ii) the use of these dependencies to predict outcomes of entirely new cases (i.e., patients). The potential contribution of ML approaches to biomedical research and healthcare is obvious in the face of large amounts of clinical and other types of data. According to the supervised learning approach of ML, a labeled set of training data is used to estimate, or map, the input data to the desired output. In supervised learning this procedure can be thought of as a classification problem. The task of classification refers to a learning process that categorizes cases into one of several predefined categories. When a classification model is developed and applied, training and generalization errors can be produced. The former refer to misclassification instances on the training data, while the latter concern the expected errors on the test (or evaluation) dataset.

While the BOUNCE multicenter, longitudinal study is currently reaching the end of its first year of following up patients, project modelers have completed the initial phase of developing and testing ML analytical tools. Concrete results have thus far been achieved using a supervised learning pipeline applied on medical, life-style, and psychological information obtained from 609 patients and their health care providers immediately following cancer diagnosis. This pipeline encapsulates a feature selection scheme with different approaches and three machine learning algorithms for predicting psychological resilience status, such as depression. A fixed sequence of steps in data preprocessing were followed and a composite estimator was built for the supervised analysis towards the identification of these factors that classify the patients into low or high levels of depression symptoms. The overall performance of the classification models was based on a validation scheme with hyperparameter optimization, which can be readily adapted to serve longitudinal prediction schemes in the future (e.g., using baseline data to predict mental health and Quality of Life status at 9, 12, and 18 months after diagnosis).

Best-performing approaches involved a meta-estimator combined with a Support Vector Machines (SVMs) classification algorithm, exhibiting balanced accuracy of 0.833, and a fair balance between sensitivity (88%) and specificity (79%). The original and normalized confusion matrices of the SVM model according to the meta-estimator feature selection scheme are depicted in Figure 4a and b, respectively. Specifically, the

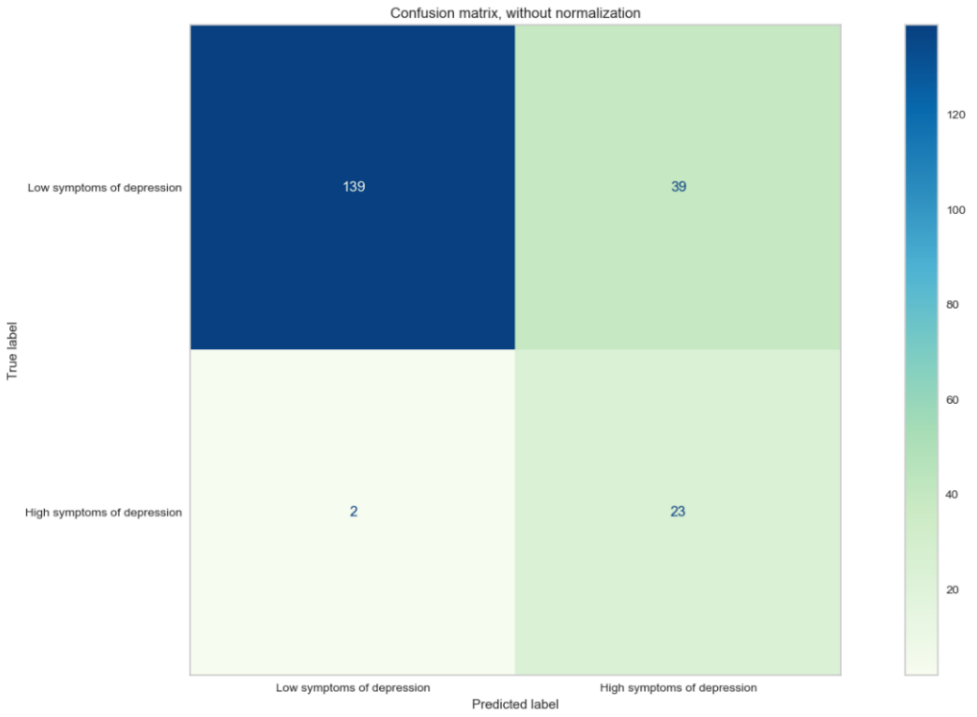

Figure 4a

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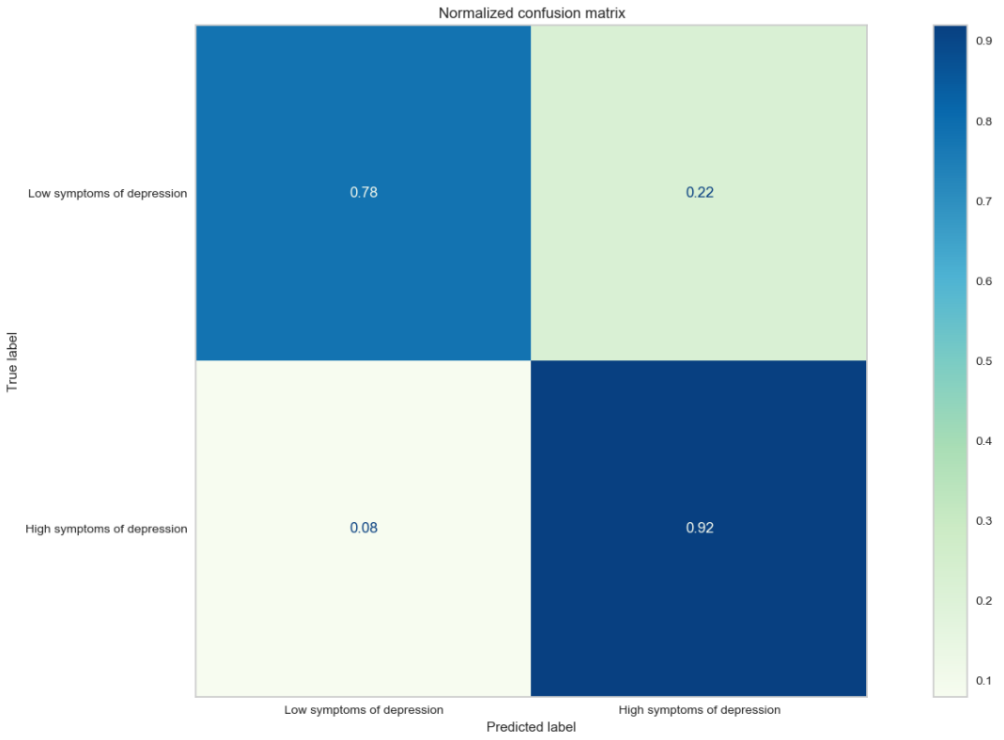

Figure4b

model correctly identified 78% of the women who did not report significant depression symptoms and 92% of the women who were at high risk for experiencing significant depression symptoms.

Closer inspection of the results revealed that features which contributed most to the correct risk-stratification of participants included psychological variables, quality of life characteristics, along with two key medical variables, i.e. cancer stage and menopausal status prior to the diagnosis. Specifically, we observed that the sense of coherence reported by participating women (that is a sense of control, meaningfulness, and positive expectations) were closely related to the levels of depression symptoms. Additional apparent determinants of such symptoms were a person's social and cognitive functioning, her perceived self-efficacy to cope with cancer and her overall sense of how resilient she can be in managing her illness. Interestingly, such traits can predict psychological health, regardless of several sociodemographic, lifestyle and disease-related factors.

Importantly, most of the factors identified by the ML models can be modified through appropriate psychological interventions. Therefore, these preliminary findings may generate ideas about potential interventions to facilitate adaptation to breast cancer. Directions for intervention would be to provide psychological support to improve quality of life when dealing with high levels of depression symptoms by taking into account the output from these models. Towards this aim, the developed ML-based infrastructure is coupled with explainable mechanisms that translate model results into meaningful and understandable decisions (e.g. how the alteration of a specific variable affects the clinical decision making), fostering a more transparent and collaborative environment between modelers and clinicians.

As data from subsequent measurement waves of the BOUNCE prospective clinical study become available, analyses will become both more comprehensive, with predictors of longer-term outcomes based on data trajectories rather than one-off measurements, as well as more clinically relevant given the potential for longer term prediction. Additionally, in ongoing analyses, we will elaborate on the richness of our dataset by modeling the trajectories of life-style (such as exercise), life-stressors, and psychological state variables during the course of cancer treatments and recovery as predictors of longer term mental health and overall well-being outcomes (i.e., at 9, 12, and 18 months post-cancer diagnosis).

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INVESTIGATING THE RELATIONSHIP BETWEEN THE COVID-19 PANDEMIC AND RELATED PARAMETERS, AND BREAST CANCER PATIENTS' PSYCHOLOGICAL AND QUALITY OF LIFE OUTCOMES

By **Diana Frasquilho**, **Sílvia Almeida**, **Berta Sousa** and **Albino J. Oliveira-Maia**, Champalimaud Research & Clinical Centre, Champalimaud Centre for the Unknown, Champalimaud Foundation, Lisbon, Portugal

The COVID-19 pandemic is a global public health and mental health crisis (Holmes et al., 2020; Torales et al., 2020). Vulnerable populations for poor mental health include individuals with pre-existing physical and/or mental health conditions (Holmes et al, 2020). Thus, this might be increasing psychological pressure to cancer patients for several reasons: overload of the hospital systems which postpone hospital visits and elective procedures; risk of covid-19 exposure during diagnostic tests; and higher risk for severe complications of COVID-19 infection when undergoing myelosuppressive treatments (Curigliano et al., 2020; Liang et al., 2020). Additionally, a higher prevalence of common mental disorders, such as Anxiety and Depression is seen in this population (as much as 18% according to some researchers; Nakash et al., 2014; Mitchell et al., 2011).

To address these issues in the context of BOUNCE, the Champalimaud group has launched a parallel study of the potential effects of the COVID-19 pandemic on the levels of psychological well-being and Quality of Life outcomes of breast cancer patients.

To this aim, we analyzed three consecutive waves of data from the BOUNCE study sample of early breast cancer patients drawn from the four country clinical sites (Lisbon, Portugal; Milan, Italy; Helsinki, Finland; Jerusalem, Israel). In addition, we will cross this data with the database established by the University of Oxford concerning COVID-19 pandemic-related parameters (OurWorldInData.org/coronavirus). Currently, we are conducting descriptive statistics and implement multilevel statistical techniques to model individual variability in psychological and Quality of Life outcomes as a function of the country-level COVID-19 pandemic parameters at a given time.

Due to the fact that the links between the pandemic and changes in psychological and Quality of Life outcomes are very complex, and lagged effects are expected, we are continuing to monitor longitudinally how BOUNCE study breast cancer participants are affected over the course of the pandemic. Additional analyses will focus on longitudinal trends and distinct behavioural patterns displayed by specific subgroups of patients.

We believe that findings related to this parallel study can contribute to increase knowledge about the impact of the COVID-19 pandemic on cancer patients and further improve quality control over BOUNCE study findings.

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BOUNCE

FUTURE EVENTS

BOUNCE experts will elaborate on important issues related to the cognitive and psychosocial quality of life of women recovering from breast cancer at a dedicated Symposium entitled: *"Interdisciplinary approaches to assess psychological resilience in breast cancer survivors"* organized by the Champalimaud Research & Clinical Centre within the International Congress of Psychology (ICP) virtual conference to be held in July 18-23 2021 ("ICP 2020").

ICP 2020+
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Specific topics include:

- Psychosocial adjustment and resilience in cancer patients from an interdisciplinary perspective by Prof. Ruth Pat-Horenczyk, Hebrew University of Jerusalem
- Neuropsychological changes associated with breast cancer patients: Current evidence by Berta Sousa, Champalimaud Research & Clinical Centre
- Online platforms to capture patient-reported outcomes and improve personalized cancer care by Paula Poikonen-Saksela, Helsinki University Hospital Comprehensive Cancer Center
- Bridging the gap between psychosocial care and oncology: The Bounce Project by Ketti Mazzocco, Istituto Europeo di Oncologia

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