UCD Impact Case Study

Accurately defining 'low risk' for early-stage breast cancer patients to avoid unnecessary treatment

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UCD School of Biomolecular and Biomedical Science

SOCIAL HEALTH ECONOMIC

SCIENTIFIC TECHNOLOGICAL TRAINING

SUMMARY

One in every eight women will develop breast cancer in her lifetime. With early diagnosis, around 70% of breast cancer patients remain tumour-free following treatment. However, 30% of patients experience a return of the cancer, which often leads to death. Herein lies the problem – how can we distinguish the 30% of aggressive cancers that need chemotherapy from the 70% that do not? Researchers at UCD and Trinity College Dublin have developed a new test called *OncoMasTR*, which analyses tumour tissue and aims to better predict which breast cancer patients can safely avoid chemotherapy. Each year, ~270,000 women worldwide are diagnosed with early-stage breast cancer[1]. *OncoMasTR* aims to spare around 190,000 of these women the harsh side-effects of chemotherapy and reduce the economic burden of these unnecessary treatments.

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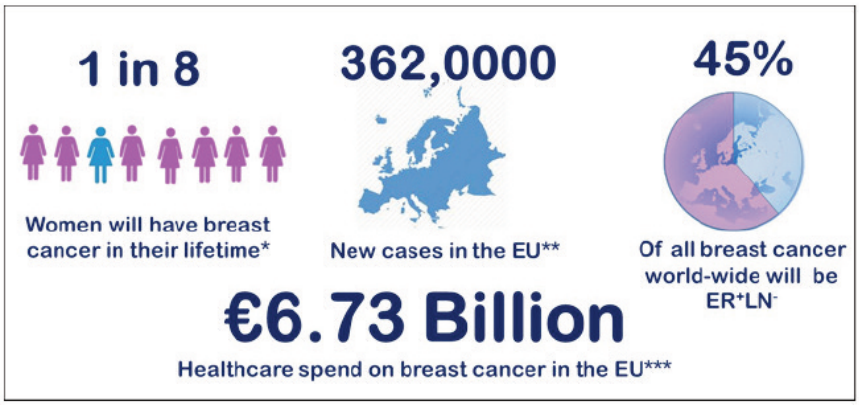
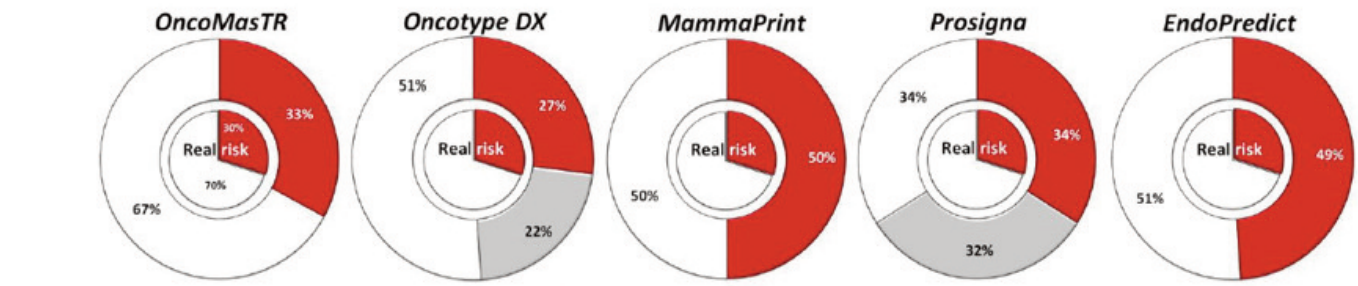


Figure 1.
EU Breast cancer statistics and economic burden.
*National Cancer Institute: Surveillance, Epidemiology and End Results Program 2010-2012, **Incidence, GLOBOCAN 2012; ***Healthcare spend on breast cancer in the EU in 2009

RESEARCH DESCRIPTION

For the majority of women with early-stage breast cancer, the standard treatment involves surgery to remove the tumour followed by a rround of radiotherapy and/or chemotherapy anti-cancer drugs to prevent cancer recurrence. These early-stage tumours have not spread outside the breast to the lymph nodes, and typically have high levels of the estrogen receptor, an indicator of good outcome.

The decision to treat these patients with chemotherapy is a difficult one for oncologists (cancer doctors), because not all women actually need this treatment. In fact, it is estimated that approximately **70% of women with early-stage breast cancer do not need chemotherapy**[2,3]. Therefore, only a minority of patients will benefit from this treatment, and the majority are unnecessarily exposed to potentially harmful treatment side effects.



Risk Group	Risk of recurrence				
Low	3%	6.8%	10%	5%	5%
Intermediate	-	14.3%	-	9%	-
High	28%	30.5%	29%	21%	22%

Figure 2. Comparing the clinical utility of the OncoMasTR assay with competitor breast cancer prognostic assays.
The inner pie charts represent the real recurrence rate of early stage ER+LN- breast cancers (30%), depicted in red as the high risk group. The outer pie charts represent the risk groups stratified by each assay, with the high risk groups depicted in red, the low risk in white and intermediate in grey (where applicable). The risk of recurrence within each group is indicated in the table below the pie charts. The *OncoMasTR* assay most closely fits the real rate of recurrence, and demonstrates the lowest risk of recurrence within the low risk group. The data represented here are those advertised by competitor assays but do not represent all published data.

This is why there is an urgent need to develop better ways to figure out which patients would actually benefit from chemotherapy. At the moment, the predictive tests that calculate recurrence risk in these patients put a large proportion of women in the "intermediate risk" group for cancer recurrence, so it remains unclear whether they actually need chemotherapy or not.

At UCD we have developed a new test called *OncoMasTR*[4], which aims to overcome this limitation by **better predicting which women can forego chemotherapy, and removing the ambiguous 'intermediate' category**.

We have demonstrated that OncoMasTR offers improved performance over existing tests by classifying 67% of patients as low-risk and 33% as high-risk. These figures **closely mirror the overall rates of recurrence that typically happen in large groups of breast cancer patients**. This work has been published in the FEBS Journal[4], and a patent has been filed with the European Patent Office[5]. The UCD team is now being funded by both the European H2020 programme and Science Foundation Ireland to drive the development of this test towards clinical use, in collaboration with the UCD spin-out company OncoMark.

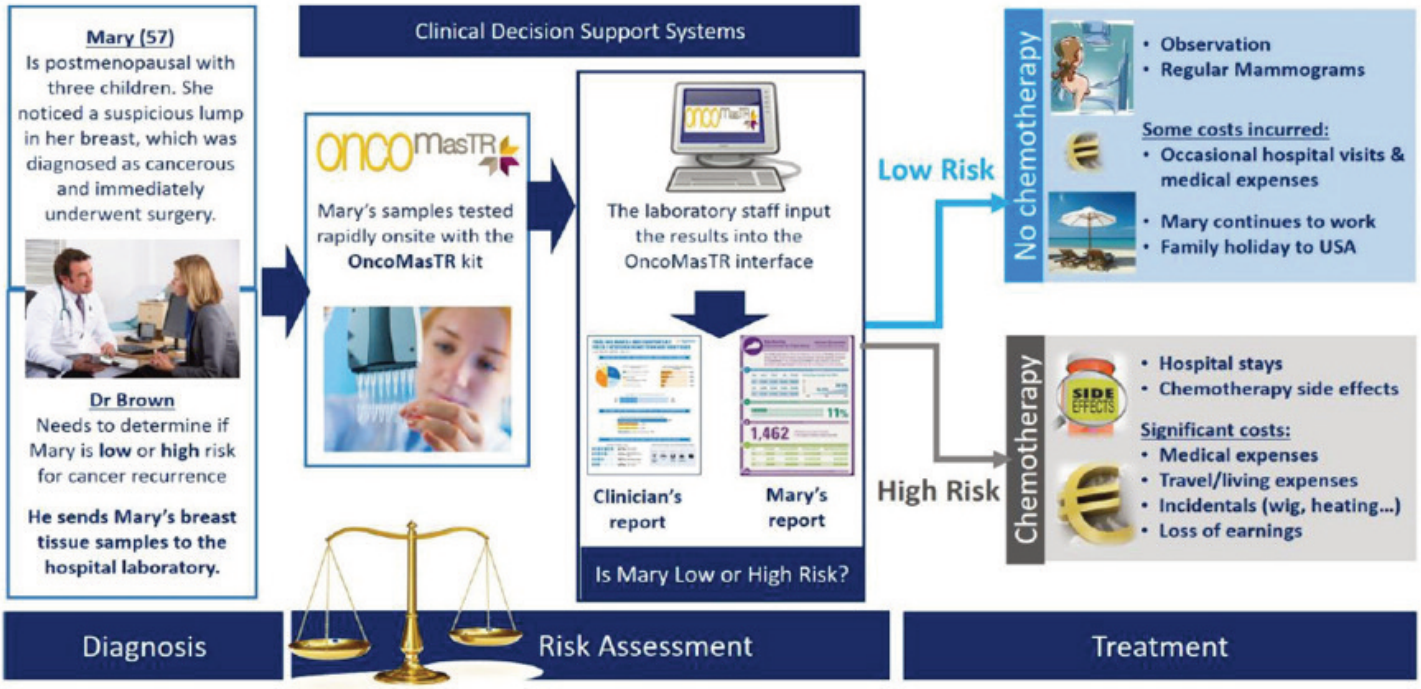


Figure 3. Impact of the OncoMasTR test on a potential patient, 'Mary', following a breast cancer diagnosis.
The decision making process and potential outcomes and impact are illustrated for a sample breast cancer patient eligible for the *OncoMasTR* test.

RESEARCH IMPACT

Health and Social Benefits

In 2012 alone, 1.7 million new breast cancer cases were diagnosed, and more than 500,000 people died from the disease[1]. This burden is expected to increase significantly in the coming years.

Chemotherapy drugs can reduce the chance of the initial cancer spreading, but the side effects can be devastating to patients, and the treatment itself can cause long-term problems even after the chemotherapy is finished.

We have developed *OncoMasTR* to identify when it is safe for early-stage breast cancer patients to forego chemotherapy, and thereby improve their quality of life and future health outlook. Every year more than 270,000 breast cancer patients in the US and EU (including more than 2,000 patients in Ireland) could potentially benefit from this test.

Economic and Technological Improvements

This research has led to substantial funding to support the further development of *OncoMasTR*. An initial grant from the Enterprise Ireland Commercialisation Fund led to a patent submission and to the publication of the original study in the scientific literature.

We also obtained funding from Science Foundation Ireland to support the *OPTi-PREDICT* Research programme[6], which currently supports 10 full-time students/staff members within UCD.

In parallel, the Irish company OncoMark, which licensed the original *OncoMasTR* technology, was granted €2.75 million in funding to bring OncoMasTR to the clinic, through the EU Horizon 2020 funding programme. This was in addition to €2.1 million in investor funding in the company to develop the *OncoMasTR* assay.

Other tests on the market to assess early stage breast cancer[7,8] are generally expensive. One example, Oncotype Dx, costs around $4,000 per test[7]. Many studies suggest there is a real economic advantage in using such tests, by reducing treatment costs[9] but we now need to develop new tests to allow more patients to safely forego chemotherapy.

The *OncoMasTR* approach gives doctors and patients a 'yes/no' result and classifies 67% of patients as low risk, compared to 34-51% for others (See Figure 2). The additional 10-30% of patients assigned to chemotherapy by the other tests is a huge strain on our already over-burdened healthcare system.

The total addressable market for *OncoMasTR* was 270,000 patients per year in the US and the EU in 2012[1], increasing at 1.5% per year. Estimating a test cost of €1,500[10], this gives a maximum worldwide market value of €1.53 billion, and potential key markets (EU, €247 million and US, €157 million) of €405 million, increasing every year.

Boosting science and training

Through the *OPTi-PREDICT* programme, which is being funded by Science Foundation Ireland to further develop *OncoMasTR*, key scientific and technological expertise will transfer from industry partners in Europe into the participating institutions in the Republic of Ireland.

OPTi-PREDICT will also encourage long-term collaborations between these partners, with a view to seeking future funding. The *OPTi-PREDICT* programme has a foundation of research excellence and it involves researchers from academic, industrial and clinical backgrounds. The training opportunities, high-impact publications, patents, expertise and knowledge gained during this project will increase the visibility of the researchers and associated institutes in the cancer arena. This in turn will inspire additional spin-off research leading to further funding opportunities and publications.

Quote from Professor William Gallagher, lead Investigator on the OPTi-PREDICT Research Programme:

"OPTi-PREDICT is a highly interdisciplinary and translational research programme, funded by Science Foundation Ireland, which will allow us to fast-track development of OncoMasTR, a novel diagnostic solution for breast cancer, one of the most significant cancer types to affect women. A key element of our approach is comprehensive validation of this new clinical test, such that it can be provided as a useful aid to spare patients from unnecessary treatment."

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