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Effective Communication of Prognosis of Breast Cancer Patients with Real-Time Estimation and Infographics

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Introduction

The diagnosis of cancer invokes fear and uncertainty in patients and their family. This may be mitigated by the timely and sensitive delivery of information. The majority of patients want information with regards to the confirmation of cancer, its treatment as well as their prognosis.

Prognosis is an issue that most doctors and patients find difficulty in discussing and the best way of presenting prognostic information to optimize patient understanding, psychological adjustment and decision-making is uncertain.

In this study, we describe the creation of an information technology (IT) tool that leverage on Electronic Health Records (EHR) to provide individualized prediction for breast cancer patients by performing real-time, matched cohort analysis (MCA) to directly calculate the expected survival and to present this information using infographics.

Methodology

A database of breast cancer patients is constructed from a combination of automated processes that input information from routine clinical processes including Multidisciplinary Boards proceedings, radiotherapy and chemotherapy prescriptions. Outcomes, treatment and financial data are retrieved from various other EHRs [Figure 1].

In order to estimate the prognosis of a specific patient, a cohort of patients can be drawn in real time from Joint Breast Cancer Registry (JBCR) matched by age, T, N, M-staging, ER, PR, HER-2 positivity and their outcomes calculated. These characteristics are relevant to breast cancer and chosen to balance accuracy and precision of estimates. More variables allow closer matching with patient and improves prediction accuracy; more variables also lead to smaller cohort and lower prediction precision.

With the aid of R packages, Survival estimates are calculated by the Kaplan Meier (KM) method. These outcomes are presented as a KM plot for physicians and scientifically literate patients. These estimates are also explained by an automatically generated prose and icon arrays.

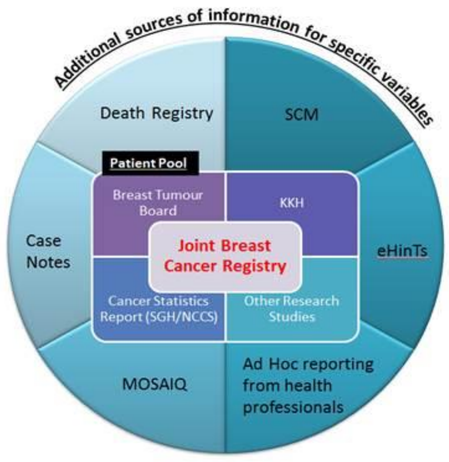

Figure 1: Sources of information

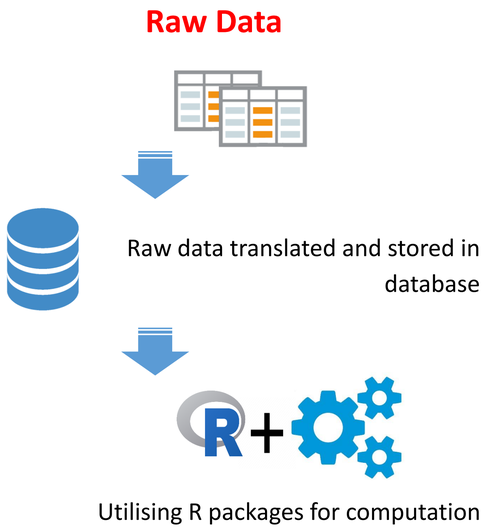

Figure 2: Method of generating required results

Results

The online real-time calculator was created and made available on the institution intranet accessible through the Survival Calculator Icon [Figure 7] from Singhealth Citrix.

The interface allows for free selection of variables to define the characteristics of the cohort selected in real time.

Physicians can peruse the KM survival plot directly or survival estimates at fixed years with 95% confidence intervals [Figure 3]. Less scientifically literate patients can be aided to understand their prognosis by an automatically generated prose in layperson language [Figure 4]. Additionally, automatically generated icon arrays further aids in illustrating these estimates as well as the uncertainty associated with it [Figure 5]. Estimated treatment-related cost is displayed to further enhance treatment-making decisions [Figure 6].

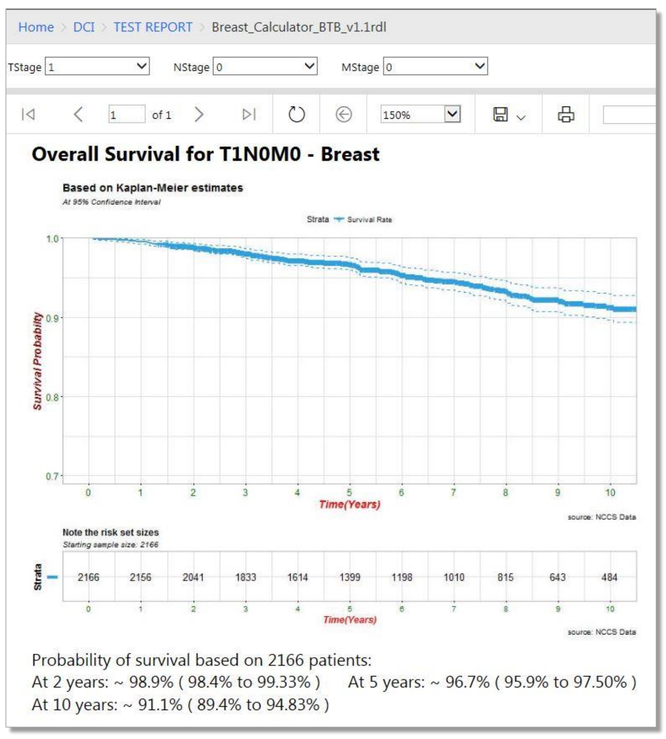

Figure 3: KM overall survival plot for the cohort of patients with T1 N0 M0 breast cancer.

In a group of 100 patients with the same characteristics as this individual patient, 96 to 98 patients would be alive 2 years after treatment. Within the same group, 89 to 93 patients would be alive 5 years after treatment.
Due to the fact that a model can never completely replicate the real world, these numbers could be lower or higher, but these are the most likely values.

Figure 4: Survival estimates for breast cancer patients with T2 N0 M0 disease explained in lay prose.

Figure 5: Survival estimates for breast cancer patients with T2 N2 M0 disease illustrated using icons arrays.

Figure 7: Survival Calculator Icon

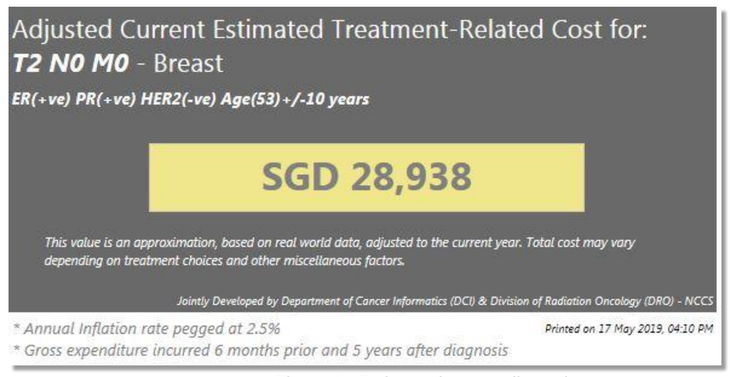

Figure 6: Estimated cost, adjusted to current year.

Conclusion

We have created a tool to perform real-time individualized estimates of breast cancer outcomes that presents accurate and precise information to both physicians and their patients, by using infographics based on a robust scientific methodology. This tool addresses the information needs of patients and bridges the communication gap with physicians by translating a complex scientific concept to a more intuitive, easily understood format. Work is in progress to apply this methodology to other cancer subsites

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