Translation of Genomics into Improvements in Cancer Prevention and Treatment

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Outline

- BACKGROUND
- RESEARCH QUESTION
- STUDY DESIGN
- PRELIMINARY RESULTS
- MY ROLE AND LESSONS LEARNED
- ACKNOWLEDGEMENTS
Background

First documentation:

- Ancient Egyptian writings (Edwin Smith Papyrus, a text book on trauma surgery) dating back to 3000 BC
- Treatment involved cauterization of the breast using ‘the fire drill’
Background: Incidence

- Breast cancer is the most common type of cancer amongst women (Nandy et al., 2013)
- In 2013 there were:
  - 2.3 million new cases in the US
  - 40 000 deaths in the US
  - 13 million new cases globally
  - 4.5 million deaths globally (Nandy et al., 2013)
- WHO anticipates cancer incidence to increase by 57% worldwide in the next 20 years (WHO, 2014)
Cancer related health spending expected to double
- 16 billion in 2010
- 22 Billion by 2022 (Marioto et al., 2011)
Why the increase?

Increase in mortality and spending can be attributed to:

- Ineffective cancer treatments
  - There are substantial inter-patient differences in response to treatment
    - Intrinsic or acquired drug resistance
    - DNA Polymorphisms
    - Presence of inter-tumor heterogenic subpopulations
  - Blockbuster treatments are effective in 40%-60% of patients
- Other factors such as longer life expectancy
Ineffective treatment calls for a paradigm shift

Personalized medicine: A tailored approach to treatment based on the molecular analysis of genes, proteins and metabolites thus affording the right treatment, to the right patient, at the right time.

“We’ve found a mass. The good news is we have weapons of mass destruction.”
Potential benefits:

- Improve treatment efficacy
- Reduce toxicity and side-effects
- Minimize cost of treatment
Research Question

What has been the effect of Oncotype DX on treatment regimen, disease-free survival, and direct medical costs amongst breast cancer patients?
Study design

Sample definition
- Cases diagnosed between Jan 1, 2007 and Dec 31, 2010
- Continuous coverage for 1 year after diagnosis
- At least one claim for breast surgery and/or Oncotype DX

Group Assignment
- Control: had surgery & no Oncotype DX
- Treatment: received Oncotype DX within 1 year of diagnosis
Study design

Outcomes:
- Chemotherapy receipt within 1 year from diagnosis
- Medical expenses (2011 USD)
- Time until death

Explanatory variables:
- Treatment vs Control
- Stage of cancer
- Prior year spending quintile
- Category for number of Elixhauser comorbidities
Analysis & preliminary results

Statistical models
- LPM & Logit
- Multinomial logistic regression
- OLS and GLM (log link, gamma family)
- Cox proportionality hazards

Controls:
- Age category
- Stage of cancer
- Minority status
- Spending quintile
- Number of Elixhauser comorbidities
Predicted probability of chemo use is lower in treatment group.
Predicted survival is higher in treatment group.
Predicted probability of death is lower in treatment group.
Predicted probability of death is lower in treatment group
Predicted probability of dying is lower in treatment group

![Graph showing predicted probability of dying across different age categories. The graph compares the probability of dying across age groups for control and treatment groups, with the treatment group showing a lower probability of dying across all age categories.](image-url)
Probability of dying is lower in treatment group
Predicted insurance chemo spending is lower in treatment group.

![Graph showing predicted real insurance chemo spending by patient age category. The graph compares the spending between control and treatment groups, with a clear trend showing lower spending in the treatment group across all age categories.]
Predicted out-of-pocket chemo spending is lower in treatment group.
My role and lessons learnt

- Literature review
  - Managing citations
  - Navigating academic database

- Data analysis (STATA)
  - “A lazy programmer is a good programmer” Andy
  - Attention to detail

- Data entry (RedCAP)
References

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Questions?