MITRE / FLUX NOTES **TREATMENT OPTIONS v2**

EDWIN CHOI, DANIEL REEVES, JUHAN SONIN, 7.NOV.2018

gōinvo

Goals

1. Communicates advantages and disadvantages of various treatment options to the patient and clinician.
2. Presentation must be visual, clear, and *accessible*.
3. Data must be relevant and meaningful.
4. The patient should analyze her values and preferences, and NOT analyze data.

Requirements

1. Data is filtered to patients with matching characteristics along various dimensions such as demographics, medical history, and genetics. The user can ease the criteria for the sample set to allow adequate sample size.
2. Supports varying number of treatment options, from simply defined to complex.
3. Be flexible in terms of types of data supported and shown/selected (survival rate, side effects, cost, etc.).

Further Considerations and Challenges

1. We must minimize our personal biases when balancing or interpreting metrics.
2. *Do not permit* the patient make a mistake in interpreting raw data! Example: the current plot shows survival time for live and deceased patients. The text gives 60 month survival rate, the goal of the chart. However, the graphical representation shows current survival time, mostly of live patients, which is NOT the same.
2. The different categories will have different amounts of data. It is very difficult to visually compare sparse to dense data, particuarly with respect to outliers.

User Scenarios

Context

1. Before meeting with a patient, the clinician uses her experience, outside knowledge, and the criteria and metric explorations within the Application to form a set of recommended treatments to discuss. During the appointment, the doctor discusses the patient's values and preferences and identifies the corresponding metrics (5 yr survival rate, 5 yr disease-free rate, etc) that address those values. They then compare treatments.
2. A recently diagnosed patient has done research and is familiar with options before an appointment. During the appointment, the doctor and patient together use the Application to understand how this patient's particular situation fits into what she learned through her research. Which of those treatments no longer make sense and won't be effective for *me*? Which of those side effects are most likely to affect *me*?
3. A progressing patient. He has tried the most common and recommended course, but the disease is still stable or progressing. The oncologist and patient discuss what options remain and how the patients' unique status affects the expected efficacy and outcomes of the different treatments.

Finding Cohorts

1. The patient is in an undersampled slice due to unique demographics or medical history. The pool of patients that match all criteria is too small. The doctor allows the Application to ease the criteria by removing those that generally have the least impact on treatment.
2. The patient has an involved and unusual treatment history. Again, the default matching pool is too small. The doctor uses her specialist information to identify several criteria that have minimal impact on treatment outcome, so she removes those filters, while retaining those criteria that capture her unsuccussful past treatments.

Table view

Table View Icon –

Each row contains the treatment name and selected metric. Survival rates can be displayed at multiple time points or as a distribution. This view is best for displaying many treatment options, with 2-3 or so different metrics. The user can easily compare a single metric across all treatments. The user is always able to dive deeper into a particular metric, as displayed below for side effects.

survival rates | design A

The user selects between survival rates at various time points or the distribution of all survival times.

Debra24 search...

Summary

Timeline

Medication

Allergies

Treatment Options

Social

Disease status

New note

Sort by most recent

+ Search filters

47 previous notes

2 Aug 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

20 Jun 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

14 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

8 May 2017
follow-up
2 Will
rber Cancer Insti...

more clinical
om 2015 - 2017

Treatment Options

Outcomes and criteria for 156,765 patients with Ductal carcinoma of the breast were collected by Cancer Link etc. etc. etc.

> **Patient selection criteria** **156** patients

> **Display** cancer specific survival rate, most common side effect, most severe side effect

Cancer specific survival rate

Textual description of relative survival rate

		5 yr	10 yr	15 yr	distr.	Most common side effect		Most severe side effect	
surgery & radiation	(32)	96%				peripheral motor ...	82%	nausea	56%
hormonal therapy	(42)	92%				anemia	77%	blood clots	32%
chemotherapy	(12)	87%				peripheral motor ...	82%	nausea	56%
chemotherapy & radiation	(5)	80%				anemia	77%	blood clots	32%
surgery	(22)	79%							
radiation	(11)	71%							
none (actively monitoring)	(3)	66%							

chemotherapy & radiation

most severe side effects

	patients	avg. grade
anemia	77% (23)	2.1
nausea	56% (16)	2.4
effect 3	43% (14)	3.1
blood clots	32% (10)	3.3

chemotherapy & radiation

most severe side effects

	grades	avg.	patients
blood clots		3.3	32% (10)
effect 3		3.1	43% (14)
nausea		2.4	56% (16)
anemia		2.1	77% (23)

Table view

survival rates | design A

Distribution of years survived yields all the information of the 3 separate toggles. This view carries all the same information as the previous and may be a clearer way to communicate short and long-term expectations.

Debra24 Hernandez98AJ | Date of birth 5 Apr 1966 (51) | Admin. sex Female | Location Boston, MA | Ductal carcinoma of the breast

Debra24 search...

Summary

Timeline

Medication

Allergies

Treatment Options

Social

Disease status

None

Treatment Options

Outcomes and criteria for 156,765 patients with Ductal carcinoma of the breast were collected by Cancer Link etc. etc. etc.

> **Patient selection criteria** **156** patients

> **Display** cancer specific survival rate, severity of side effects

Cancer specific survival rate

Textual description of relative survival rate

5 yr 10 yr 15 yr **distr.**

		Distribution of years survived	Most common side effect		Most severe side effect	
surgery & radiation	(32)	15+ 10-15 5-10 <5	peripheral motor ...	82%	nausea	56%
hormonal therapy	(42)		anemia	77%	blood clots	32%
chemotherapy	(12)		peripheral motor ...	82%	nausea	56%
chemotherapy & radiation	(5)		anemia	77%	blood clots	32%
surgery	(22)		peripheral motor ...	82%	nausea	56%
radiation	(11)		anemia	77%	blood clots	32%
none (actively monitoring)	(3)		anemia	77%	blood clots	32%

New note

Sort by most recent

+ Search filters

47 previous notes

2 Aug 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

20 Jun 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

14 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

8 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

View 10 more clinical notes from 2015 - 2017

Table view

survival rates | design B

As a second option, as displayed here and in the next composition, multiple bars can be stacked ontop one another.

Debra24 search...

Summary

Timeline

Medication

Allergies

Treatment Options

Social

Disease status

Treatment Options

Outcomes and criteria for 156,765 patients with Ductal carcinoma of the breast were collected by Cancer Link etc. etc. etc.

> **Patient selection criteria** **156** patients

> **Display** cancer specific survival rate, severity of side effects

Cancer specific survival rate

Textual description of relative survival rate

5 yr | **10 yr** | **15 yr**

		0% 20 40 60 80 100%	Most common side effect		Most severe side effect	
surgery & radiation	(32)		peripheral motor ...	82%	nausea	56%
hormonal therapy	(42)		anemia	77%	blood clots	32%
chemotherapy	(12)		peripheral motor ...	82%	nausea	56%
chemotherapy & radiation	(5)		anemia	77%	blood clots	32%
surgery	(22)		peripheral motor ...	82%	nausea	56%
radiation	(11)		anemia	77%	blood clots	32%
none (actively monitoring)	(3)		anemia	77%	blood clots	32%

New note

Sort by most recent

+ Search filters

47 previous notes

2 Aug 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

20 Jun 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

14 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

8 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

View 10 more clinical notes from 2015 - 2017

Debra24 Hernandez98Aj | Date of birth 5 Apr 1966 (51) | Admin. sex Female | Location Boston, MA

Ductal carcinoma of the breast

Debra24 search...

Summary
Timeline
Medication
Allergies
Treatment Options
Social
Disease status

Allergies

None

Treatment Options

Outcomes and criteria for 156,765 patients with Ductal carcinoma of the breast were collected by Cancer Link etc. etc. etc.

Patient selection criteria 156 patients

Display cancer specific survival rate, severity of side effects

Cancer specific survival rate

Textual description of relative survival rate

5 yr | 10 yr | 15 yr

		0% 20 40 60 80 100%	Most common side effect		Most severe side effect	
surgery & radiation	(32)		peripheral motor ...	82%	nausea	56%
hormonal therapy	(42)		anemia	77%	blood clots	32%
chemotherapy	(12)		peripheral motor ...	82%	nausea	56%
chemotherapy & radiation	(5)		anemia	77%	blood clots	32%
surgery	(22)		peripheral motor ...	82%	nausea	56%
radiation	(11)		anemia	77%	blood clots	32%
none (actively monitoring)	(3)		anemia	77%	blood clots	32%

New note

Sort by most recent

+ Search filters

47 previous notes

2 Aug 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

20 Jun 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

14 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

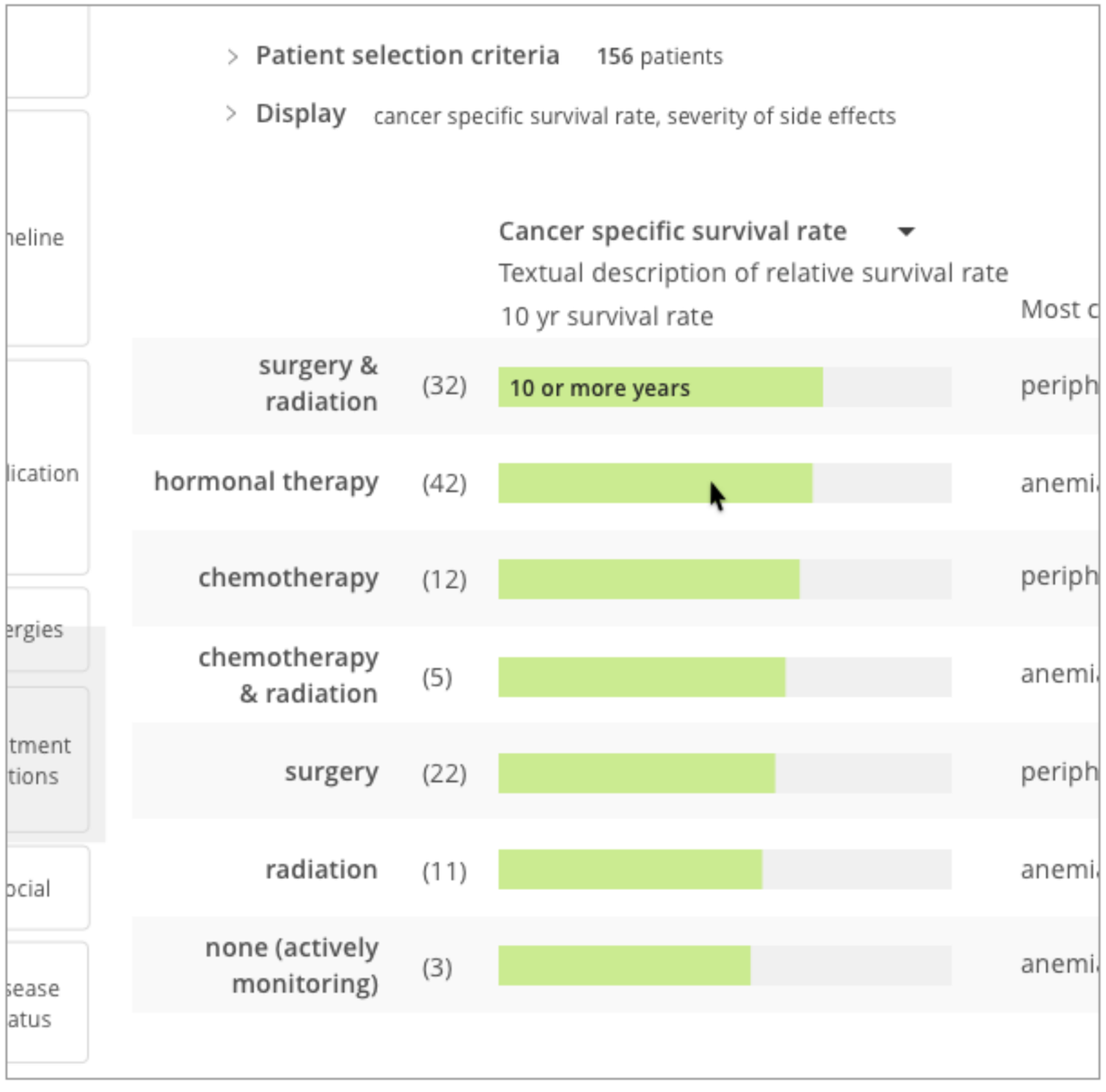
8 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

View 10 more clinical notes from 2015 - 2017

Table view

survival rates | design C

In this alternative design, the distribution view is initially displayed. To access the 5yr/10yr/ 15yr survival rate, the user taps on the corresponding section of any stacked bar.



Treatment Card View

Treatment Card Icon –

Each card presents the name of the treatment, the number of patients included in the pool, and a section for each metric. Each metric supports a drilldown (on tap or mouse hover) that gives more details. This view accentuates each treatment as a whole, and helps the user digest all the dimensions of the treatment to form a complete picture.

Debra24 search...

Summary

Timeline

Medication

Allergies

Treatment Options

Social

Disease status

Treatment Options

Outcomes and criteria for 156,765 patients with Ductal carcinoma of the breast were collected by Cancer Link etc. etc. etc.

Patient selection criteria **156** patients

Display cancer specific survival rate, severity of side effects, annual OOP cost

Surgery and Radiation 32 patients

95% 15 year survival rate

29% 45% 16%

Side effects severity

$12K Annual OOP cost

Radiation 11 patients

60% 15 year survival rate

29% 31% 30

Side effects severity

$8K Annual OOP cost

Chemotherapy 12 patients

95% 15 year survival rate

Surgery 22 patients

60% 15 year survival rate

New note

Sort by most recent

+ Search filters

47 previous notes

2 Aug 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

20 Jun 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

14 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

8 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

View 10 more clinical notes from 2015 - 2017

Treatment Card View

Single metric focus

Debra24 Hernandez98Aj | Date of birth: 5 Apr 1966 (51) | Admin. sex: Female | Location: Boston, MA | Ductal carcinoma of the breast

Debra24 search...

Summary

Timeline

Medication

Allergies

Treatment Options

Social

Disease status

Treatment Options

Outcomes and criteria for 156,765 patients with Ductal carcinoma of the breast were collected by Cancer Link etc. etc. etc.

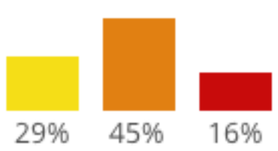
Patient selection criteria 156 patients

Display cancer specific survival rate, severity of side effects, annual OOP cost

Surgery and Radiation

32 patients

95% 15 year survival rate



Side effects severity

$12K Annual OOP cost

Radiation

11 patients

60% 15 year survival rate

5 yr | 10 yr | **15 yr**

10 qualifying patients were diagnosed 15+ years ago and received Radiation. **6** (60%) survived 15+ years.

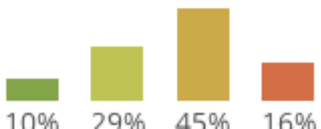
60% is **lower** than most other treatments for qualifying patients.

Other study results

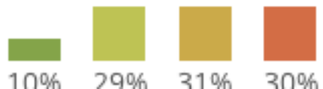
Chemotherapy

12 patients

95% 15 year survival rate



Side effects severity



Side effects severity

New note

Sort by most recent

+ Search filters

47 previous notes

2 Aug 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

20 Jun 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

14 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

8 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

View 10 more clinical notes from 2015 - 2017

Integration of treatment cards with table

In this and the next concept, the Treatment Cards are accessed via selection on the table. Rather than being a separate view, they are treated as way to compare 2 or 3 treatment options or as a way to get a different, deeper view of a particular treatment of interest.

Integration | design A | Selected Card Gallery

Treatments are selected via a selection box and displayed below the table. The user can elect additional data for the cards.

Summary

Timeline

Medication

Allergies

Treatment Options

Social

Disease status

> **Patient selection criteria** 156 patients

> **Display** cancer specific survival rate, severity of side effects

Cancer specific survival rate

Textual description of relative survival rate

	5 yr	10 yr	15 yr	distr.	Most common side effect		Most severe side effect	
✓ surgery & radiation	(32)			96%	peripheral motor ...	82%	nausea	56%
hormonal therapy	(42)			92%	anemia	77%	blood clots	32%
chemotherapy	(12)			87%	peripheral motor ...	82%	nausea	56%
chemotherapy & radiation	(5)			80%	anemia	77%	blood clots	32%
surgery	(22)			79%	peripheral motor ...	82%	nausea	56%
✓ radiation	(11)			71%	anemia	77%	blood clots	32%
none (actively monitoring)	(3)			66%	anemia	77%	blood clots	32%

> **Additional data** annual OOP cost

Surgery and Radiation — 32 patients

Radiation — 11 patients

New note

Sort by most recent

+ Search filters

47 previous notes

2 Aug 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

20 Jun 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

14 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

8 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

View 10 more clinical notes from 2015 - 2017

Integration of treatment cards with table

Integration | design B | Single Full Card

Treatments are directly selected by tapping the title and a single card with all available data is displayed.

Debra24 search...

Summary

Timeline

Medication

Allergies

Treatment Options

Social

Disease status

Treatment Options

Outcomes and criteria for 156,765 patients with Ductal carcinoma of the breast were collected by Cancer Link etc. etc. etc.

> **Patient selection criteria** **156** patients

> **Display** cancer specific survival rate, severity of side effects

Cancer specific survival rate

Textual description

5 yr 10 yr 15

			Most severe side effect	
surgery & radiation	(32)		nausea	**56%**
hormonal therapy	(42)		blood clots	**32%**
chemotherapy	(12)		nausea	**56%**
chemotherapy & radiation	(5)		blood clots	**32%**
surgery	(22)		nausea	**56%**
radiation	(11)		blood clots	**32%**
none (actively monitoring)	(3)		blood clots	**32%**

Surgery and Radiation — 32 patients

96% — **15 year survival rate**

29% 45% 16%

Side effects severity

peripheral motor ...	82%
anemia	78%
nausea	72%

Common side effects

$12K — **Annual OOP cost**

New note

Sort by most recent

+ Search filters

47 previous notes

2 Aug 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

20 Jun 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

14 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

8 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

View 10 more clinical notes from 2015 - 2017

Criteria Selection

Initially, the criteria are all active to produce a cohort as similar to the patient as possible. Here, however, that has resulted in a pool of only 10 patients, and the resulting data is not useful.

Debra24 Hernandez98AJ | Date of birth 5 Apr 1966 (51) | Admin. sex Female | Location Boston, MA | Ductal carcinoma of the breast

Debra24 search...

Summary

Timeline

Medication

Allergies

Treatment Options

Social

Disease status

Allergies

None

Treatment Options

Outcomes and criteria for 156,765 patients with Ductal carcinoma of the breast were collected by Cancer Link etc. etc. etc.

> **Patient selection criteria** 10 patients: ease criteria to show more

> **Display** cancer specific survival rate, severity of side effects

Cancer specific survival rate

Textual description of relative survival rate

5 yr | **10 yr** | **15 yr** | distr.

		0% 20 40 60 80 100%	Most common side effect		Most severe side effect	
surgery & radiation	(3)		peripheral motor ...	66%	nausea	33%
hormonal therapy	(6)		anemia	100%	blood clots	50%
chemotherapy	(1)		peripheral motor ...	100%	nausea	100%

New note

Sort by most recent

+ Search filters

47 previous notes

2 Aug 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

20 Jun 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

14 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

8 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

View 10 more clinical notes from 2015 - 2017

Criteria Selection

The user then opens the criteria selector. The slider controls the number of criteria selected. The order of selection/deselction of criteria by the slider is predetermined and is indicated in the informational popup. Alternatively, the user can manually select and deselect criteria. Each criteria (“race”) is shown with the active value (“white”) and the percent patients in the ENTIRE pool (“61%”) who share that value.

Debra24 Hernandez98AJ | Date of birth 5 Apr 1966 (51) | Admin. sex Female | Location Boston, MA | Ductal carcinoma of the breast

Debra24 search...

Summary

Timeline

Medication

Allergies

Treatment Options

Social

Disease status

Treatment Options

Outcomes and criteria for 156,765 patients with Ductal carcinoma of the breast were collected by Cancer Link etc. etc. etc.

Patient selection criteria 10 patients: ease criteria to show more

least selective, 156,765 patients — 10 — most selective, 10 patients

excluded criteria: none

- **demographic** 3/3 active
  - ✓ age: 51-61 (25%)
  - ✓ race: white (61%)
  - ✓ sex: male (49%)
- **genetics** 4/4 active
- **pathology** 4/4 active
- **disease history** 3/3 active

slider excludes criteria in this order:

race
sex
family history
surgery
age
BRCA2
radiation
ER
PR

Display cancer specific survival rate, severity of side effects

Cancer specific survival rate

Textual description of relative survival rate

5 yr | 10 yr | 15 yr | distr.

		0% 20 40 60 80 100%	Most common side effect		Most severe side effect	
surgery & radiation	(3)		peripheral motor ...	66%	nausea	33%
hormonal therapy	(6)		anemia	100%	blood clots	50%
chemotherapy	(1)		peripheral motor ...	100%	nausea	100%

New note

Sort by most recent

+ Search filters

47 previous notes

2 Aug 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

20 Jun 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

14 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

8 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

View 10 more clinical notes from 2015 - 2017

Criteria Selection

The user has pushed the slider somewhat towards the left, “least selective” side. Several criteria have been deactivated and the patient pool is now significant.

Debra24 search...

Summary

Timeline

Medication

Allergies

Treatment Options

Social

Disease status

Treatment Options

Outcomes and criteria for 156,765 patients with Ductal carcinoma of the breast were collected by Cancer Link etc. etc. etc.

Patient selection criteria **156** patients

156

least selective, 156,765 patients — most selective, 10 patients

excluded criteria: race, sex, family history, surgery

- **demographic** 1/3 active
  - ☑ age: 51-61
  - ☐ race: white
  - ☐ sex: male
- **genetics** 4/4 active
- **pathology** 4/4 active
- **disease history** 1/3 active

slider excludes criteria in this order:

race
sex
family history
surgery
age
BRCA2
radiation
ER
PR

Display cancer specific survival rate, severity of side effects

Cancer specific survival rate

Textual description of relative survival rate

5 yr | **10 yr** | **15 yr** | distr.

		0% 20 40 60 80 100%	Most common side effect		Most severe side effect	
surgery & radiation	(32)		peripheral motor ...	82%	nausea	56%
hormonal therapy	(42)		anemia	77%	blood clots	32%
chemotherapy	(12)		peripheral motor ...	82%	nausea	56%
chemotherapy & radiation	(5)		anemia	77%	blood clots	32%
surgery	(22)		peripheral motor ...	82%	nausea	56%

New note

Sort by most recent

+ Search filters

47 previous notes

2 Aug 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

20 Jun 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

14 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

8 May 2017
Clinical follow-up
Dr. Free2 Will
Dana Farber Cancer Insti...

View 10 more clinical notes from 2015 - 2017