

Swedish National  
Breast Cancer Study

Karma

## Karma TYRER-CUZICK and BOADICEA variables

Karma calculates the TYRER-CUZICK scoring and the BOADICEA (Breast and Ovarian Analysis of Disease Incidence and Carrier Estimation Algorithm) scoring based on the data Karma collects from the study participants responding to a web based questionnaire.

TYRER-CUZICK and BOADICEA calculates the individual/population risk of developing breast/ovarian cancer based on familial history and lifestyle factors.

The Tyrer-Cuzick algorithm requires following input factors (as compared to BOADICEA)

### Similarities in accounting for risk factors

- Age
- BRCA-gene mutation
- Ovarian cancer
- Ashkenazi origin
- Family: breast (incl. bilateral) / ovarian cancer age
- Relatives: breast/ovarian cancer age

### Differences

#### *In Tyrer-Cuzick only*

- BMI
- Age at menarche
- Age at first child
- Menopause (pre/peri/post)
- HRT use (previous/current/planned)
- Benign breast disease (hyperplasia, atypical hyperplasia, LCIS, unknown)
- \*Mortality of non-BC causes (competing risk)

#### *In BOADICEA only*

- Twin cancer status
- Pancrea/prostate cancer in family

Karma holds the following TYRER-CUZICK and BOADICEA variables.

## **TYRER-CUZICK**

TYRER-CUZICK (named after its creators) is a risk model for predicting breast cancer risks for individuals and for the population in general. The model computes risk for breast cancer based on overall population risk and for individualized family history, lifestyle factors, and the probability of carrying BRCA genes and other predisposing genes. The population risk is given by national breast cancer incidence rates, e.g. Swedish, stratified by woman age. The individualized risk is given for each individual as the deviation in risk from the average woman at a certain age. If the average age for menarche is 13 in population and the woman in question had menarche at age 10, then this woman will be at higher risk of developing breast cancer due to the menarche risk factor. The risk for the individual woman is the overall population risk plus/minus the specific deviation of risk for the woman.

More details are available at <https://ems-trials.org/riskevaluator/>

## **General variables**

### **age\_riskassessed**

Age of woman at risk assessment. Healthy women and non-prevalent BC cases have their risk assessed at survey interview date. Invasive and insitu BC cases have their risk assessed at year of BC. BMI and HRT are assessed at interview date (not BC date) for the BC cases.

### **age\_interview**

Age at survey interview.

### **yearofbirth**

Year of birth.

**started\_time**

Time of survey interview.

**bc\_1stdiagdate**

Date of first BC diagnosis.

**bc\_prevalent**

BC diagnosis prior to survey interview date.

**bc\_malign**

Invasive BC diagnosis.

**Individual breast cancer risk (1.0 is 1%)****risk\_breastcancer\_own\_1yr**

Individual risk for developing breast cancer in 1 year.

**risk\_breastcancer\_own\_2yr,3yr,4yr,5yr,10yr,20yr,lifetime**

Individual risk for developing breast cancer in 2-20 years or in (remaining) lifetime.

**Breast cancer risk in population****risk\_breastcancer\_pop\_1yr**

Population risk for developing breast cancer in 1 year.

**risk\_breastcancer\_pop\_2yr,3yr,4yr,5yr,10yr,20yr,lifetime**

Population risk for developing breast cancer in 2-20 years or in (remaining) lifetime.

**Individual mutation carrier probability****prob\_brca1\_own\_mutation**

Individual probability of carrying a BRCA1 mutation.

**prob\_brca2\_own\_mutation**

Individual probability of carrying a BRCA2 mutation.

**prob\_brca\_own\_nomutation**

Individual probability of not carrying any BRCA mutation.

**Mutation carrier probability in population****prob\_brca1\_pop\_mutation**

Probability of carrying a BRCA1 mutation in population.

**prob\_brca2\_pop\_mutation**

Probability of carrying a BRCA2 mutation in population.

**prob\_brca\_pop\_nomutation**

Probability of not carrying any BRCA mutation in population.

**Risk factors in Tyrer-Cuzick score****menacrche**

Age at menarche.

**parous**

Parity. 0 is no liveborn children, 1 is one or more children, 2 is unknown.

**age\_1**

Age at giving birth to first child.

**menostat**

Menopausal status, 0 is pre, 1 is peri, 2 is post. 3 is unknown.

**ht**

Length.

**wt**

Weight.

**hyper**

Diagnosed with any type of hyperplasia.

**ah**

Diagnosed with atypical hyperplasia.

**lcis**

Diagnosed with lobular cancer in-situ.

**ovarian\_status**

Diagnosed with ovarian cancer.

**ageoc**

Age at ovarian cancer diagnosis.

**menacrche**

Age at menarche.

**ashkanazi**

Ashkenazi jewish descent.

**hrt\_use**

Use of hormonal replacement therapy. 0 is no use, 1 is more than 5 years ago, 2 is less than 5 years ago, 3 is current use.

**hrt\_type**

Type of HRT used. 0 is estrogen only HRT, 1 is combined HRT tablet.

**inuselength**

Years of HRT use. Not coded in Karma.

**hrt\_last\_use**

Years since last use of HRT.

**genetic\_test**

Genetic test performed. 0 is never, 1 negative test, 2 is BRCA1, 3 is BRCA2.

**father\_genetic\_test**

Genetic test performed on father to woman. 0 is never, 1 negative test, 2 is BRCA1, 3 is BRCA2.

**mother\_affected\_status**

Mother with breast ancer. 0 is no, 1 is yes.

**mother\_ovarian\_status**

Mother with ovarian ancer. 0 is no, 1 is yes.

**mother\_age**

Age when mother developed BC.

**mother\_bilateral\_age**

Age when mother developed bilateral BC.

**n\_sisters**

Numbers of sisters.

## **System variables**

**version**

Tyrer-Cuzick algorithm version.

## **BOADICEA**

BOADICEA (Breast and Ovarian Analysis of Disease Incidence and Carrier Estimation Algorithm) is a risk model for familial breast and ovarian cancer. The model can be used to compute age specific risks for breast and ovarian cancer and builds on family history pedigrees. The data used in BOADICEA is collected as part of the Karma web based questionnaire and will be used for estimating BRCA1/2 carrier ship in the Karma unselected population.

More details are available at <https://www.canrisk.org/>

### **Breast and ovarian cancer risks (0.01 is 1%)**

#### **risk\_breastcancer\_1yr**

Risk for developing breast cancer in one year.

#### **risk\_breastcancer\_2yr, 3yr, 4yr, 5yr, 10yr, 15yr, 20yr, 25yr**

Risk for developing breast cancer in x years.

#### **risk\_ovariancancer\_1yr**

Risk for developing ovarian cancer in one year.

#### **risk\_ovariancancer\_2yr, 3yr, 4yr, 5yr, 10yr, 15yr, 20yr, 25yr**

Risk for developing ovarian cancer in x years.

#### **age**

Age at assessment.



**yearofbirth**

Year of birth.

**BRCA1/BRCA2 mutation carrier probabilities****prob\_brca1\_mutation**

Probability of carrying a BRCA1 mutation.

**prob\_brca2\_mutation**

Probability of carrying a BRCA2 mutation.

**prob\_brca\_nomutation**

Probability of not carrying any BRCA mutation.

**System variables****interview\_end**

Date of assessing the BOADICEA raw variables.