

Empowering breast health: Personalized approaches to breast cancer screening

CanPath Webinar – October 19th, 2023

Jennifer Brooks, MSc, PhD.

Executive Director CanPath

Associate Professor of Epidemiology

Dalla Lana School of Public Health

University of Toronto

Breast Cancer in Canada



1/8 WOMEN WILL DEVELOP
BREAST CANCER
DURING HER LIFE

~1/5 CASES
OCCUR IN WOMEN < 50 YEARS OLD

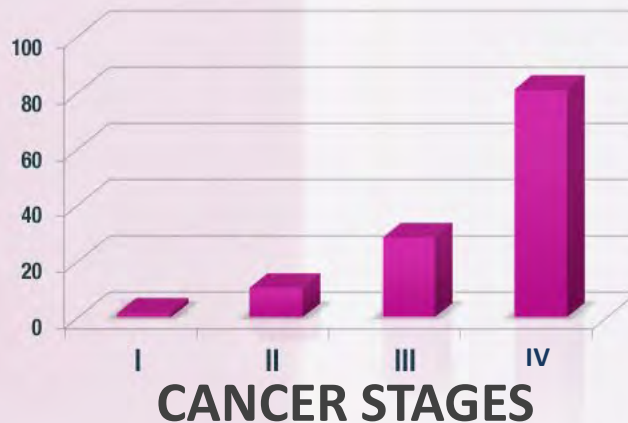


27 400
NEW CASES/YEAR

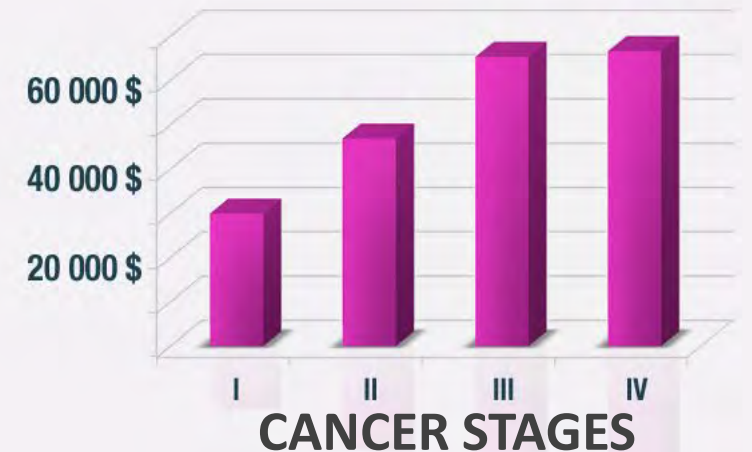
5 000

DEATHS ARE ATTRIBUTED TO THIS
CANCER EACH YEAR

RELATIVE MORTALITY RATIO (5 YRS)



MEAN COST OF CARE (2 YRS)



Breast Screening in Canada

- Canadian Taskforce on Preventive Health Care recommends screening women ages 50 to 74 years with mammography every 2 to 3 years
- Many screening programs screen outside these guidelines
- Some programs recommend MRI with mammography for women at high risk

Overall – guidelines are based on **age** rather than **risk**

May result in over-screening women at lower risk and underscreening women at higher risk

Ontario Breast Screening Programs

Ontario Breast Screening Program (OBSP)

Started in July 1990

50 to 74 years
75+ (referral)

Age-based eligibility

232 screening centers
2 mobile coaches
73 assessment centers

Mammogram every two years or
Annually based on family history*, density, &
benign breast disease

Risk-based eligibility

Started in July 2011

30 to 69 years

1. Known Gene Mutation Carrier
2. Untested First Degree Relative
3. Family History & Risk $\geq 25\%$
4. Radiation therapy to chest

33 screening centers
23 genetic clinics,
8 laboratories

Mammogram and MRI
(or ultrasound) every year with doctor referral

Age- and Risk-based eligibility

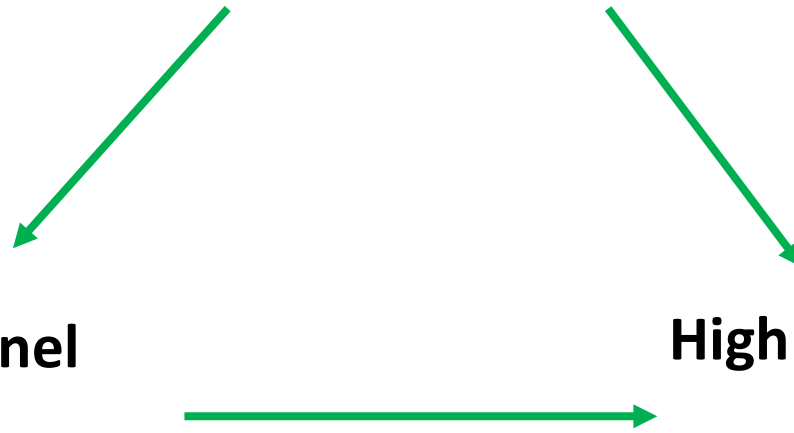
*first-degree family history of breast or ovarian cancer

Breast Cancer Risk Assessment

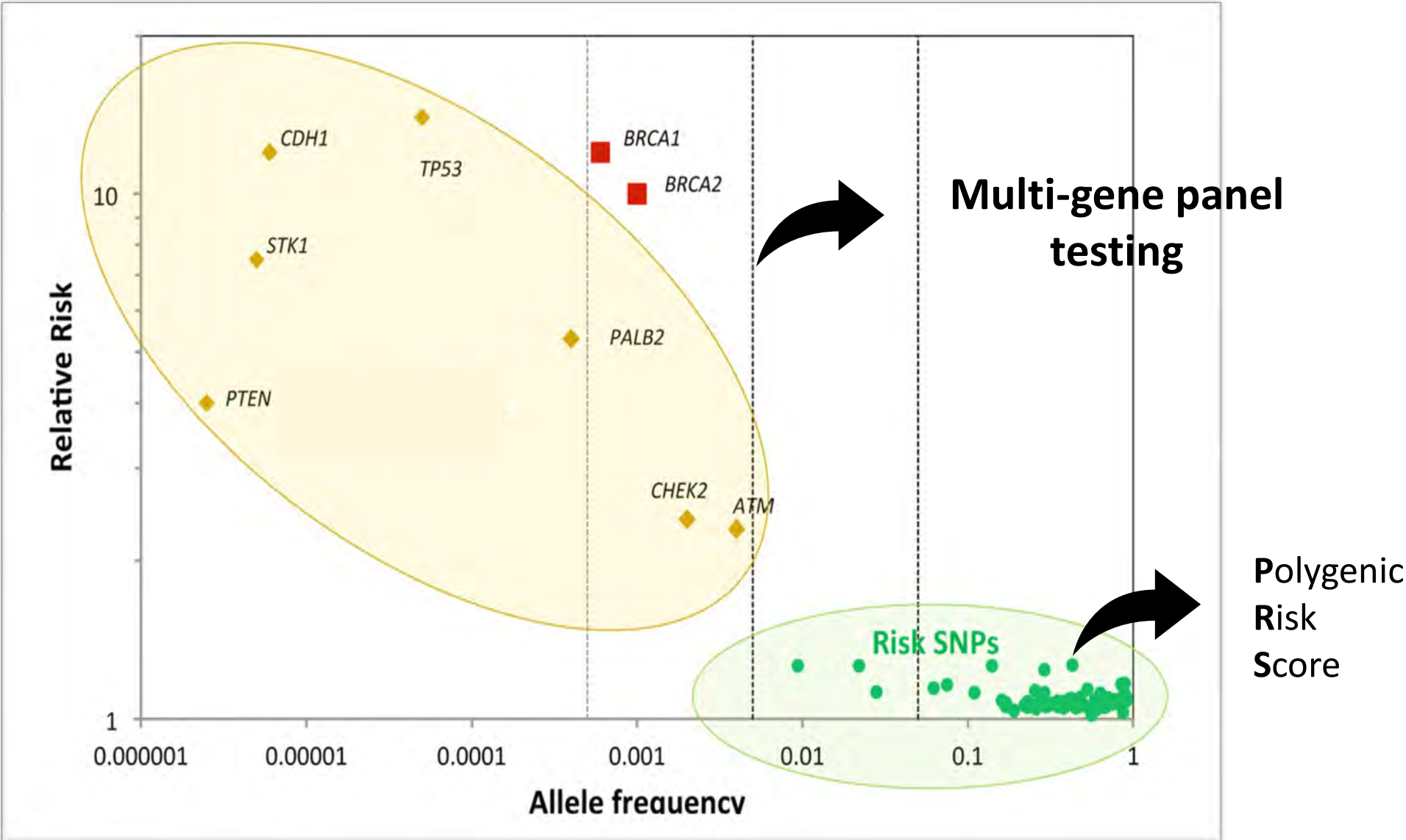
- Many women receive approximate risk estimates based on their family history
- Risk prediction tools (e.g., BOADICEA, IBIS) are currently used in genetic clinics (in Ontario) to assess breast cancer risk and/or risk of carrying a mutation

**Multi-gene panel
testing**

**High Risk Screening
Program**



Genetic architecture of breast cancer



Slide provided by Dr. Jacques

Open

Corrected: Author Correction



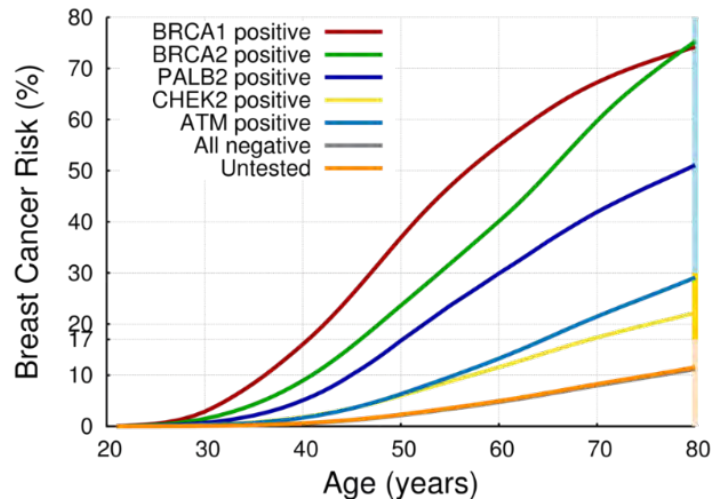
BOADICEA: a comprehensive breast cancer risk prediction model incorporating genetic and nongenetic risk factors

Andrew Lee, MSci, CASM¹, Nasim Mavaddat, MBBS, PhD¹, Amber N. Wilcox, MPH²,
Alex P. Cunningham, MSc, PhD¹, Tim Carver, PhD¹, Simon Hartley, MSc, PhD¹,
Chantal Babb de Villiers, PhD³, Angel Izquierdo, MD⁴, Jacques Simard, PhD⁵,
Marjanka K. Schmidt, PhD⁶, Fiona M. Walter, MD, FRCGP³, Nilanjan Chatterjee, PhD^{7,8},
Montserrat Garcia-Closas, MPH, DrPH², Marc Tischkowitz, MD, PhD⁹, Paul Pharoah, PhD^{1,10},
Douglas F. Easton, PhD^{1,10} and Antonis C. Antoniou, PhD¹

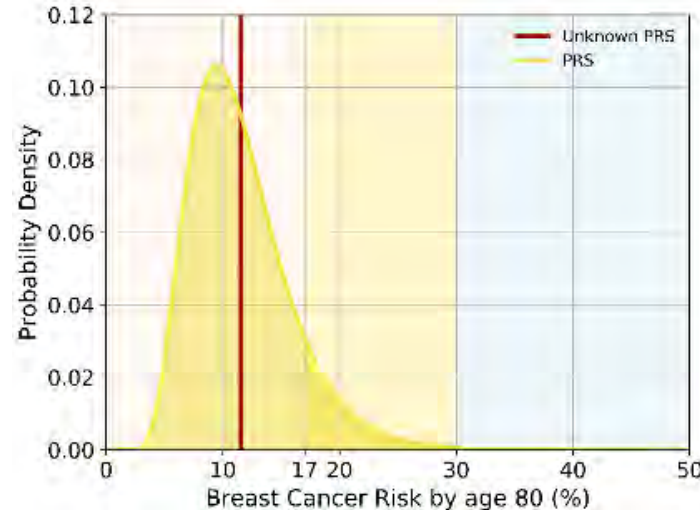
Lee et al, Genet Med. 2019 Jan 15. doi: 10.1038/s41436-018-0406-9

BOADICEA version 5

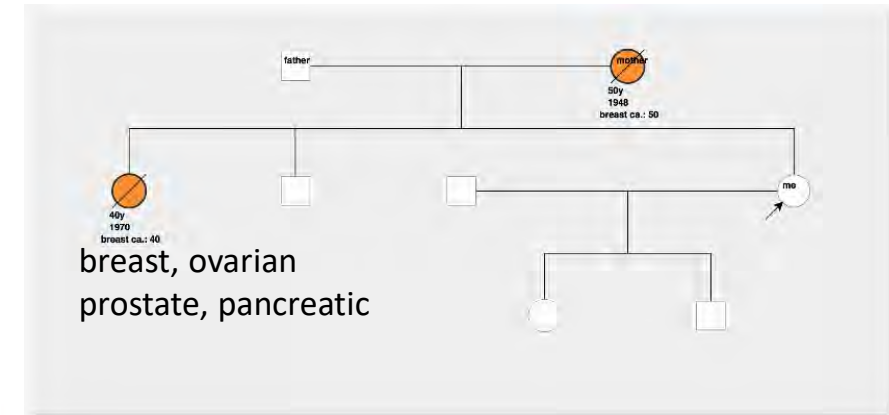
Rare Genetic Variants



Polygenic Risk Score



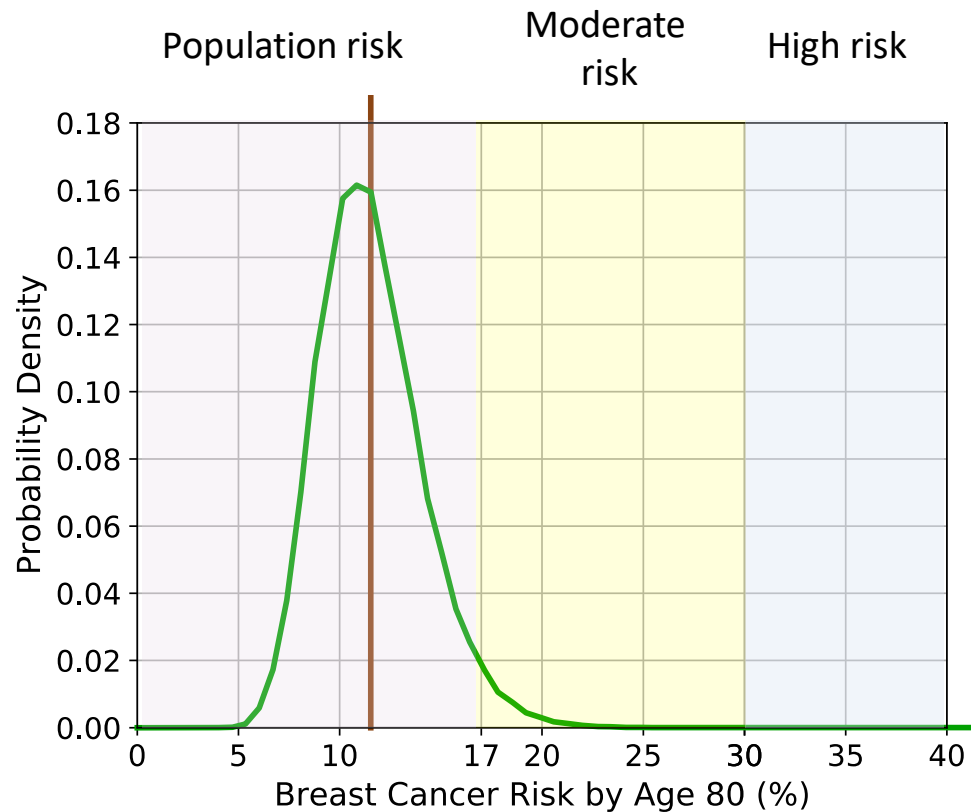
Family History



- Other unobserved genetic effects
- Lifestyle/hormonal/reproductive risk factors
- Breast tumour characteristics: ER/PR/HER2
- Population demographics

Combining risk factors altogether: risk stratification example

NICE clinical management risk categories



— Risk factors only

Risk categories

Pink=near population risk ($< 17\%$)

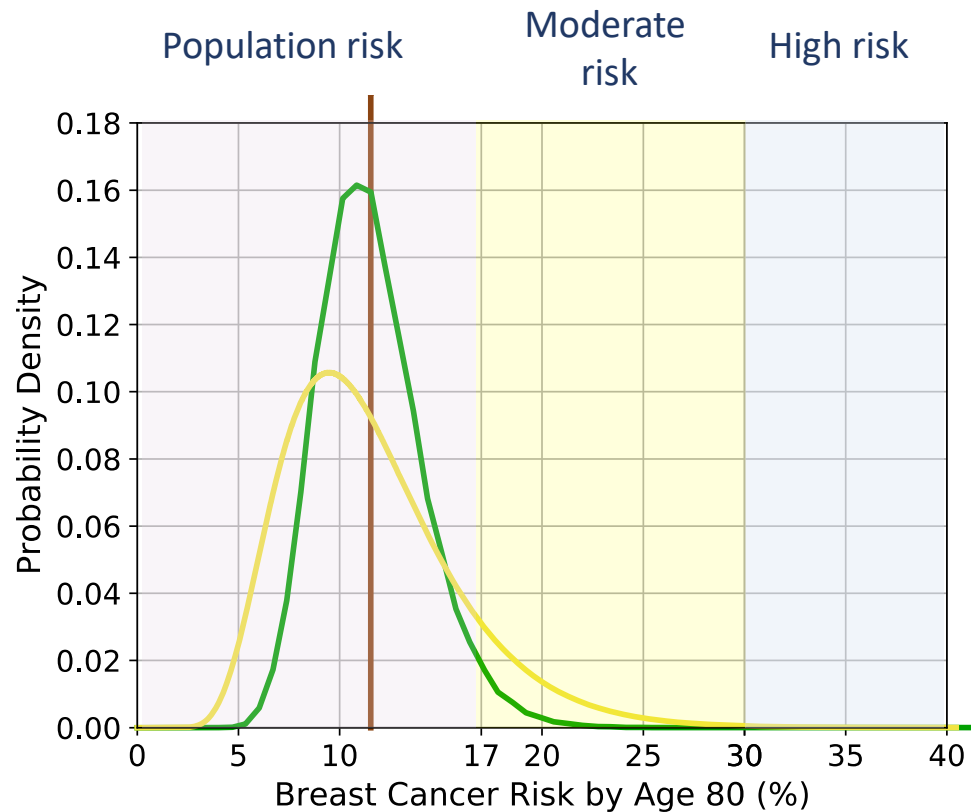
Yellow=moderate risk ($\geq 17\%$ and $< 30\%$)

Blue=high risk ($\geq 30\%$)

Lee et al Genet Med 2019

Combining risk factors altogether: risk stratification example

NICE clinical management risk categories



— Risk factors only

— Genetics (SNPs, PRS) only

Risk categories

Pink = near population risk ($< 17\%$)

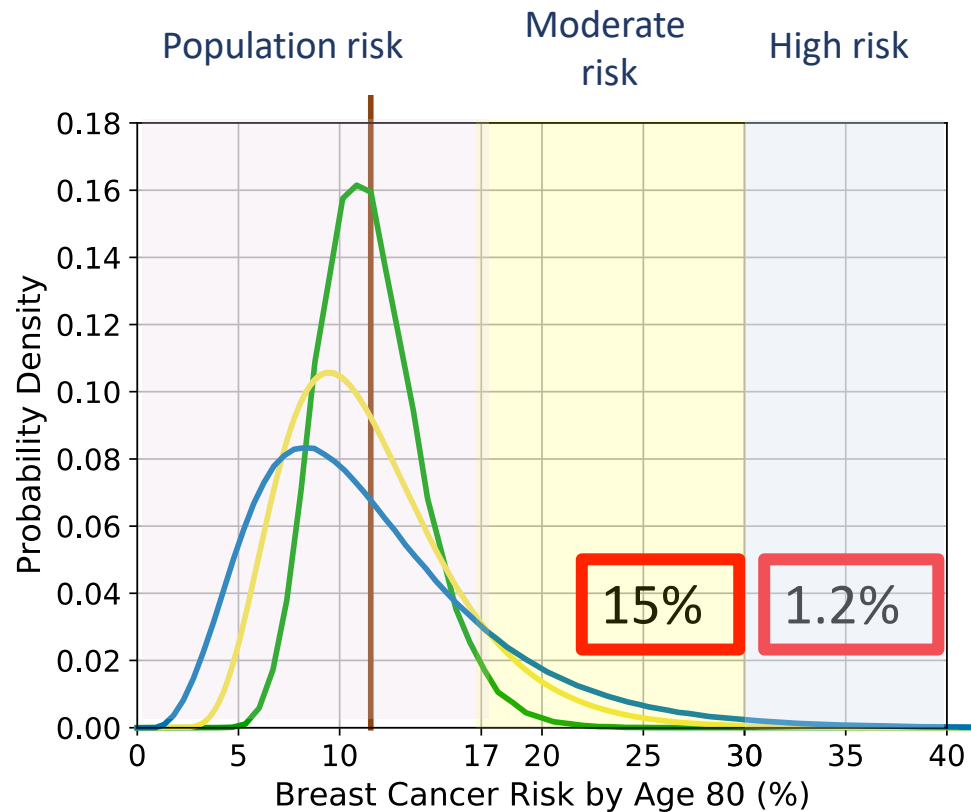
Yellow = moderate risk ($\geq 17\%$ and $< 30\%$)

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Lee et al Genet Med 2019

Combining risk factors altogether: risk stratification example

NICE clinical management risk categories



- Risk factors only
- Genetics (SNPs, PRS) only
- Combined – full model

Risk categories

Pink = near population risk (< 17%)

Yellow = moderate risk (≥ 17% and < 30%)

Blue = high risk (≥ 30%)

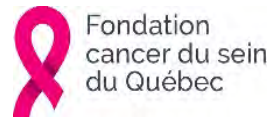
Lee et al Genet Med 2019



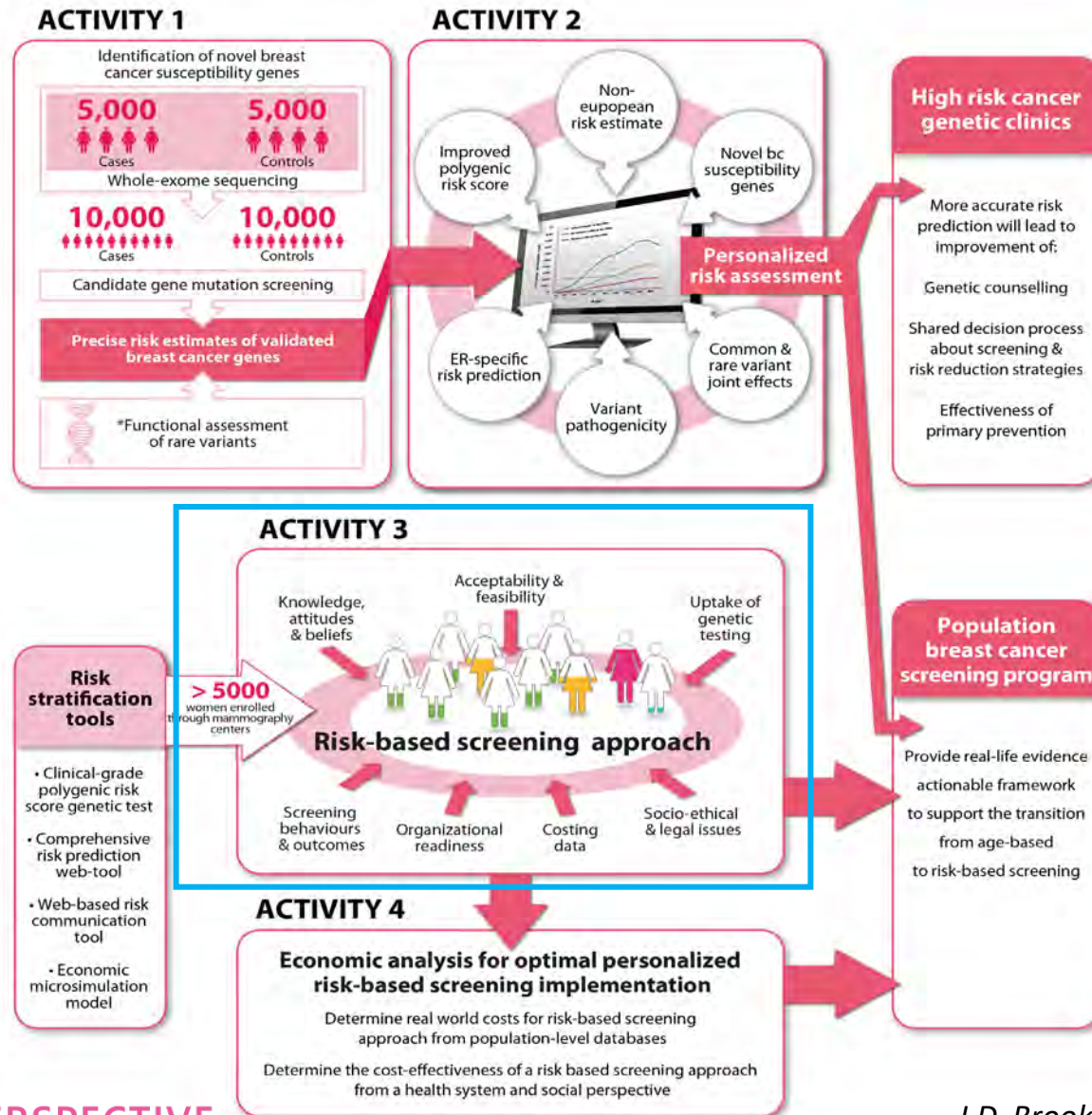
PERSPECTIVE
INTEGRATION & IMPLEMENTATION

Personalized Risk Assessment for the Prevention and Early Detection of Breast Cancer: Integration & Implementation (PERSPECTIVE I&I)

Co-Leads: Jacques Simard & Anna M. Chiarelli



PERSPECTIVE I&I: Research Strategy



OVERARCHING GOALS:

- To improve personalized risk assessment to offer **cost-effective risk-based screening and prevention** of breast cancer to individuals most likely to benefit.
- To determine the **optimal implementation approaches** within the Canadian healthcare system.



Activity 2

Customize BOADICEA to the Canadian Population



GenomeCanada



CIHR IRSC



GenomeQuébec



Fondation
cancer du sein
du Québec



Économie
et Innovation

Québec



Centre de recherche



Ontario Health
Cancer Care Ontario

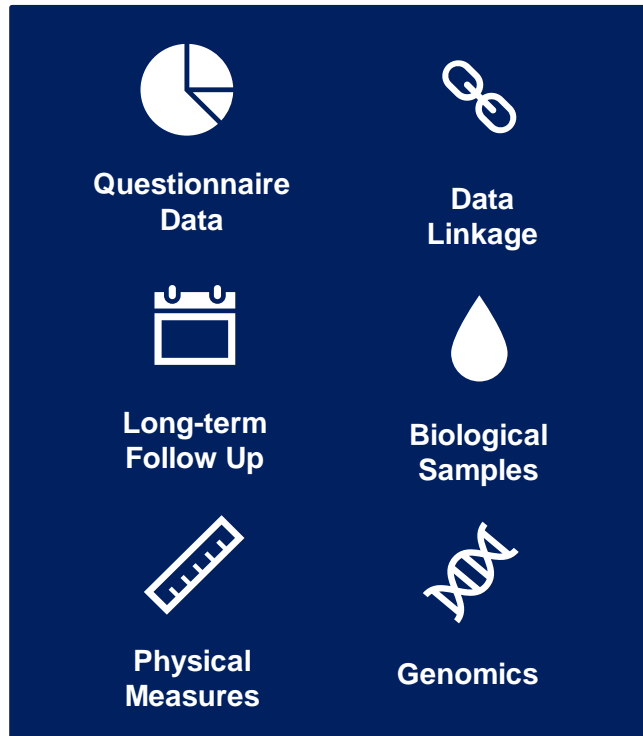
Adaptation and Validation of BOADICEA in Canadian population

Calibration of the BOADICEA tool for use within the Canadian population.

- 1) Generate prevalence estimates for breast cancer risk factors included in BOADICEA
- 2) Generate estimates of the association between each available risk factor and breast cancer risk for incorporation into BOADICEA.
- 3) Prospectively validate the calibrated BOADICEA model in Canadian cohorts.



CanPath is following the health of over 330,000 adult Canadians for decades



Adaptation and Validation of BOADICEA in Canadian population

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Comparing CanPath, CCHS and BOADICEA Distributions: BMI

	BOADICEA	CanPath	CCHS
	%	%	%
Self-reported BMI (kg/m²)^c			
<18.5	3.3	1.7	2.2
18.5-24.9	35.7	43.8	42.3
25.0-29.9	35.8	30.0	30.7
≥30.0	25.2	24.6	24.9

Comparing CanPath and BOADICEA Estimates: BMI

Self-reported BMI (kg/m ²) (age 20-49)	BOADICEA	CanPath Cases/Controls	OR (95%CI)
<18.5	1.28	12/1116	1.29 (0.72, 2.32)
18.5-24.9	1.00	239/24911	Ref
25.0-29.9	0.92	133/14300	0.91 (0.73, 1.12)
≥30.0	0.74	103/13102	0.81 (0.64, 1.03)

Comparing CanPath and BOADICEA Estimates: Age at Menarche

Age at menarche (y)	BOADICEA	CanPath Cases/Controls	OR (95%CI)
<11	1.19	303/10955	1.15 (1.01, 1.31)
11	1.09	682/25306	1.08 (0.98, 1.19)
12	1.07	1359/50212	1.10 (1.02, 1.19)
13	1.00	1335/51041	Ref
14	0.98	685/26487	0.98 (0.90, 1.08)
15	0.92	253/11259	0.86 (0.75, 0.98)
>15	0.82	218/8428	1.01 (0.88, 1.17)

Comparing CanPath and BOADICEA Estimates: Number of live births

Live births (all women)	BOADICEA	CanPath Cases/Controls	OR (95%CI)
Nulliparous	1.00	197/8155	Ref
1 Birth	0.87	695/28188	0.92 (0.79, 1.09)
2 Births	0.81	1863/68759	0.87 (0.75, 1.01)
>2 Births	0.71	1047/39165	0.73 (0.62, 0.85)

Adaptation and Validation of BOADICEA in Canadian population

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Confluence

Uncovering breast cancer genetics

More than doubling the size of
current breast cancer GWAS

<https://dceg.cancer.gov/Confluence>

Lead by: Montserrat Garcia-Closas – (moved to ICR London)

Now lead by: Peter Kraft, Gretchen Gierach

Project Manager: Tom Ahearn



>300,000
Breast Cancer
Patients



>300,000
Controls



International
Multi-racial

Illumina Global Screening Array

>665,000 variants

Multi-Ethnic Genotyping Array (MEGA)

>1.3M variants

Custom content ~ 100K variants

Confluence progress to date

- 300,222 cases and 228,852 controls
- **Current CanPath Total: 904 cases and 1396 controls**
- 5 Consortia and 224 studies
- February 2023 – first freeze for receiving new data/biospecimens
- Genotyping is on-going – expected to be completed by the end of this year
- Analysis for initial concepts to start January 2024

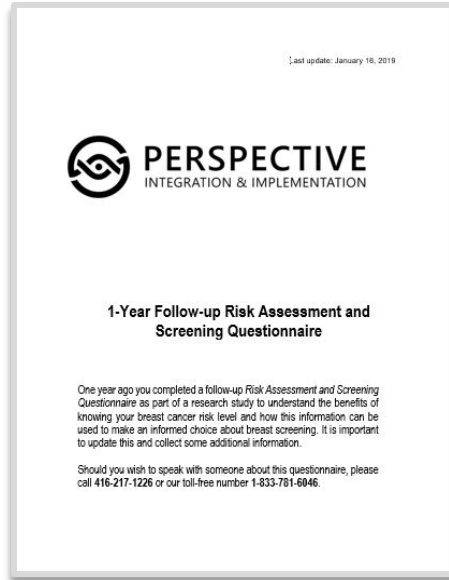
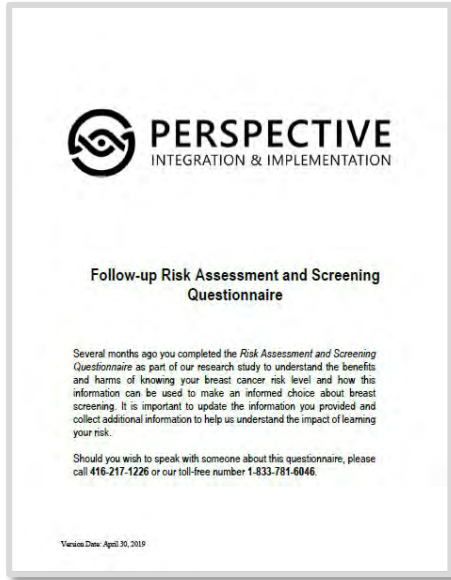
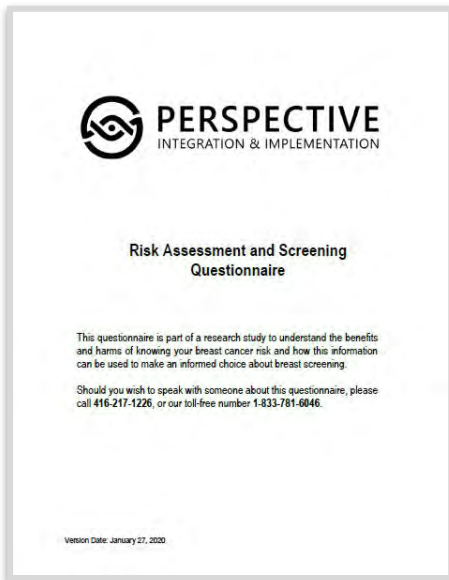
Activity 3

Pre-Implementation Study

Overall Objective

Evaluate acceptability and uptake of risk-based approach to breast cancer screening in Ontario and Quebec

- Recruit ~5,000 women ages 40 to 69 screened at one of six Ontario Breast Screening Program (OBSP) sites or in Quebec through Dec. 2021
- Exclusion criteria: breast, ovarian or pancreatic cancer; known high risk; had genetic testing and/or counselling for breast cancer

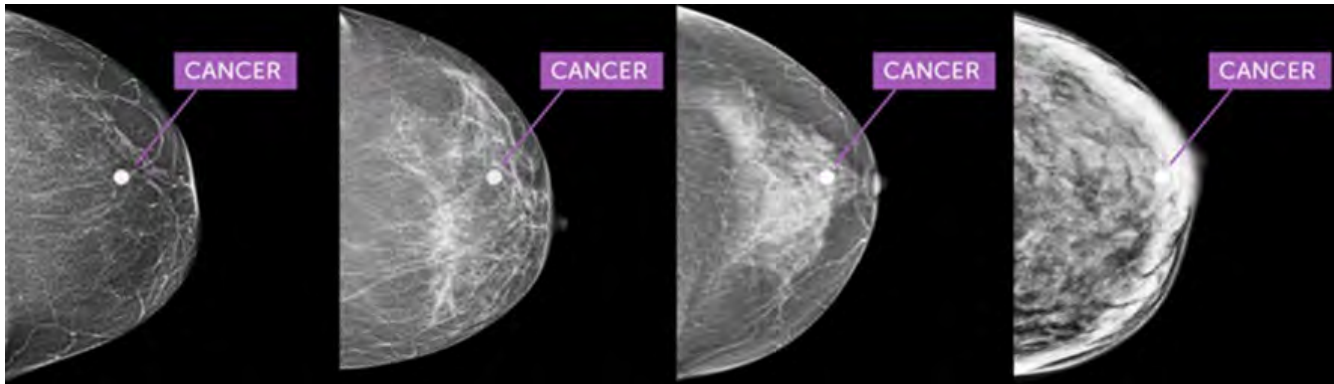


Almost entirely fatty

Scattered fibroglandular

Heterogeneously Dense

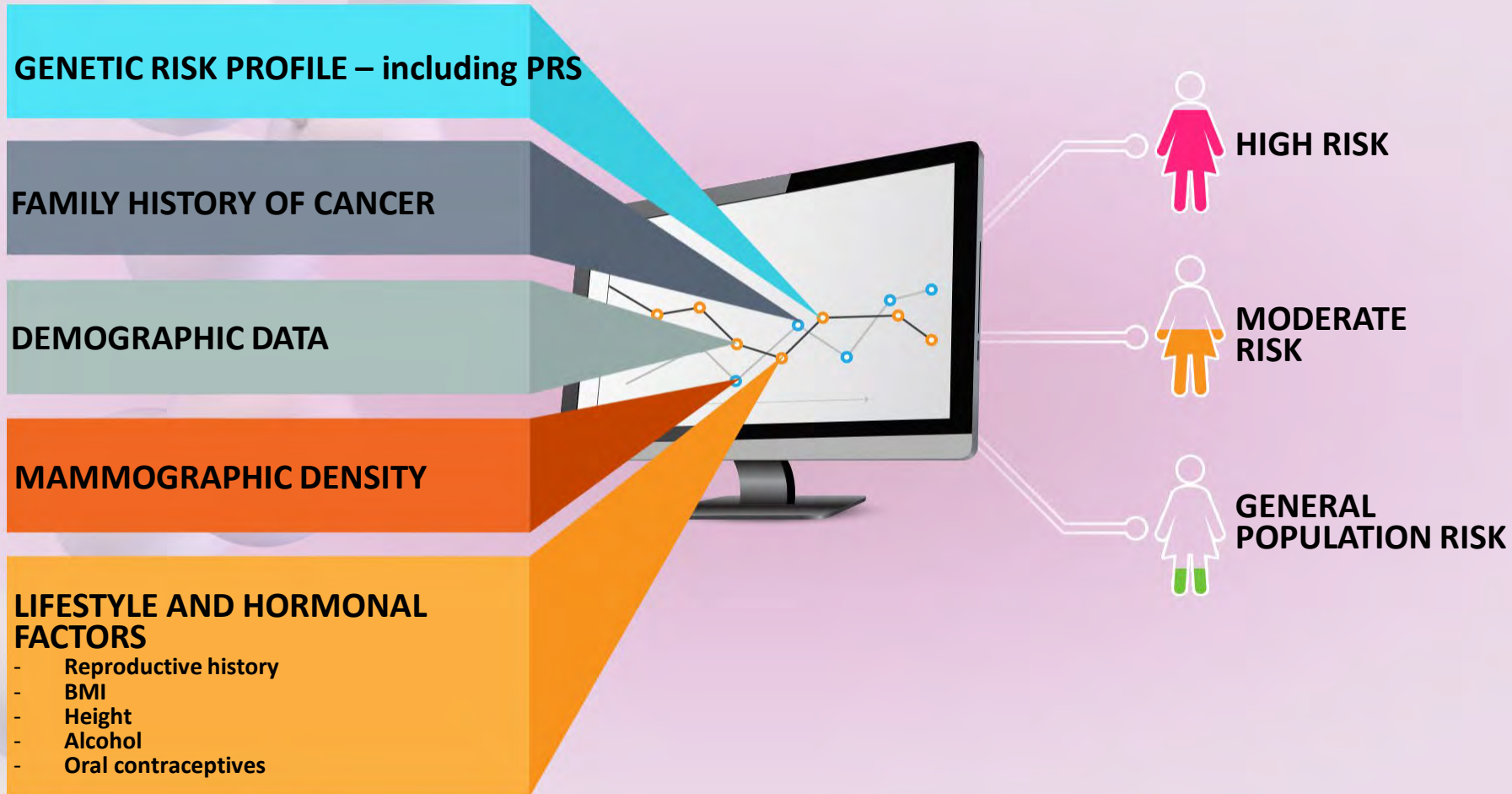
Extremely Dense



PRS: BCGR SNP test ~300 SNPs

- Next generation sequencing of SNPs
- Clinical grade
- Standard operating procedures
- Assay designed for high volume/low-cost

Risk Assessment: CanRisk (BOADICEA)



Outputs
5-year risk
10-year risk
Lifetime risks

Risk Prediction: CanRisk Web Tool

The screenshot shows the CanRisk web tool interface. At the top, there is a navigation bar with links for Home, Tool, Web services, Guide, About, and Logout (cencisa). Below this, the CanRisk logo is displayed on the left, and the text 'BOADICEA V Breast and Ovarian Analysis of Disease Incidence and Carrier Estimation Algorithm Welcome' is on the right. A red bar contains buttons for Load, Save, Reset, and Preferences. Below the bar, a legend explains icons: a green checkmark for completed stages, a red triangle for mandatory fields, and a blue 'i' for hover information. A blue bar labeled 'CanRisk Tool' is above the 'Personal Details' section. The 'Personal Details' section contains five input fields: 'Are you?' (dropdown menu showing 'Female'), 'In which country do you currently live?' (dropdown menu showing 'Canada'), 'What is your date of birth?' (text input with format 'dd/mm/yyyy' and 'DOB:--/--/-- Your Age is:--'), 'How tall are you?' (text input with example 'e.g. 123.5cm', unit dropdown 'cm', and 'Metric' button), and 'What is your current weight?' (text input with example 'e.g. 73.5kg', unit dropdown 'kg', 'Metric' button, and 'Your BMI is:--').

Inputs:

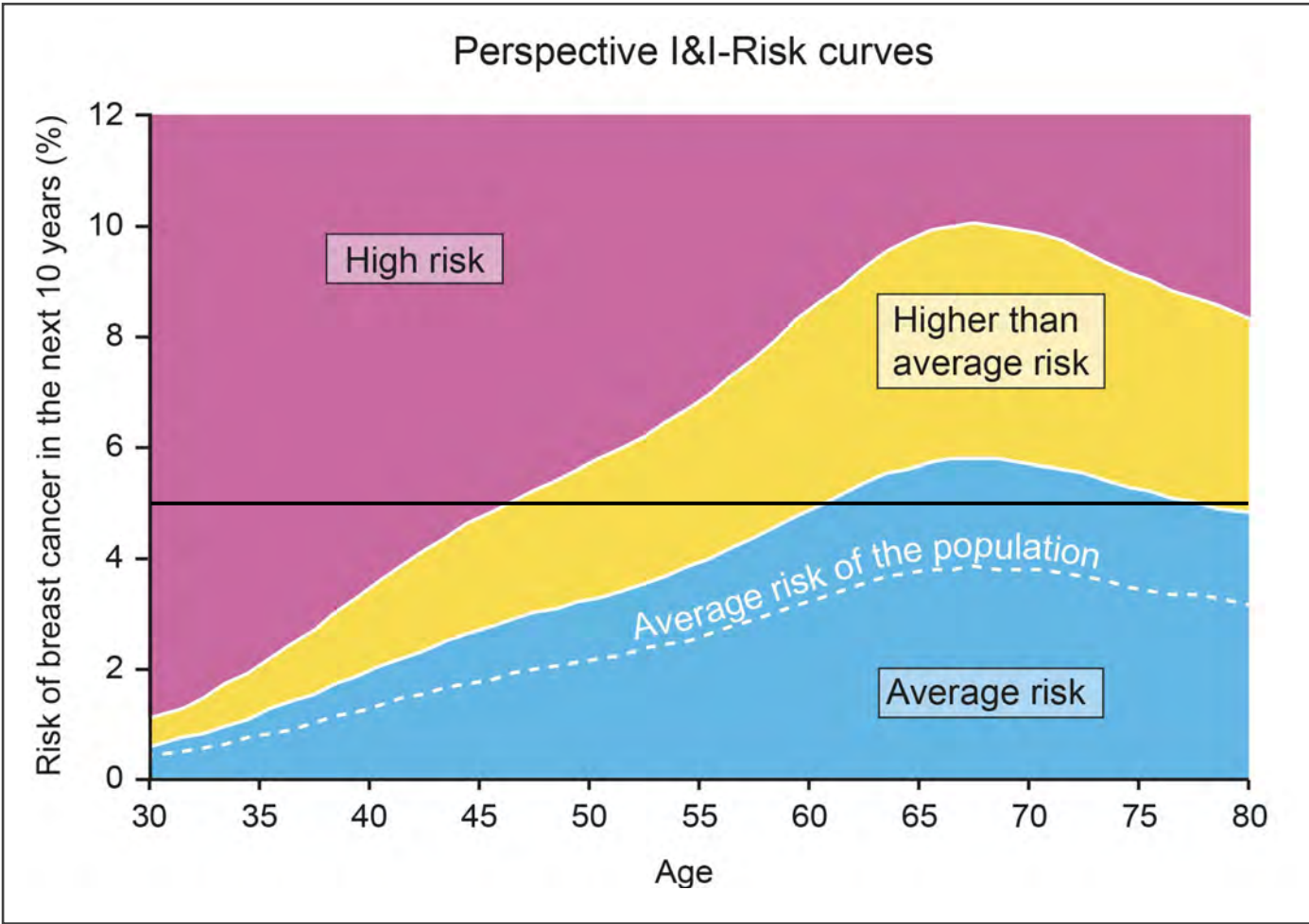
- Risk factors
- Family History
- BI-RADS Density
- Polygenic Risk Score

Outputs:

- 5-year risk
- 10-year risk
- Lifetime risks

A. Lee et al. *Genetics in Medicine* 21, 1708–1718 (2019)

Risk Categories: 10-year absolute risk



SCREENING ACTION PLAN

40-69 years: Annual mammogram and MRI

40-49 years: Talk to doctor about screening



50-69 years: Annual mammogram

40-49 years: No regular screening

50-69 years: Biennial mammogram

*10 year absolute risk scaled to remaining lifetime risk (RLR) at age 30 (the anchor) to age 80.

Personalized Risk Communication Letter

Date _____
Address Line 1 _____
Address Line 2 _____

Online Questionnaire URL Address
D2.PERSPECTIVEstudy.ca
Online Questionnaire No.: #####

Dear | _____

Thank you for participating in our *Personalized Risk Assessment for Prevention and Early Detection of Breast Cancer: Integration and Implementation (PERSPECTIVE I&I)* study. You have now completed the *Risk Assessment and Screening Questionnaire* <Date completed>, provided a saliva sample for genetic testing, and given us permission to collect your mammogram report.

We have used this information to estimate your breast cancer risk level and to propose a screening action plan.

Your Risk Level: High

In Canada, about <number> out of 1000 women your age may develop breast cancer over the next 10 years.

Your estimated risk for developing breast cancer is much higher than most Canadian women your age. In this risk level, about <number> or more out of 1000 women your age may get breast cancer over the next 10 years.

Your Screening Action Plan:

Women your age who have a high risk of developing breast cancer can get screened every year with a mammogram and breast magnetic resonance imaging (MRI) (or screening ultrasound if MRI is not right for you). Talk with your doctor or a nurse practitioner about whether you may be eligible for the High Risk Ontario Breast Screening Program. Please see referral form at: cancerontario.ca/sites/cancerontario/files/assets/OBSP-HighRiskForm.pdf

What's next?

Please read the booklet on **Understanding Your Breast Cancer Risk Assessment** with information about how we estimated your risk and what you can do to reduce your risk.

A genetic counsellor will contact you to discuss your **Risk Level** and **Action Plan**. Please note the study genetic test does not check for rare genetic mutations affecting specific genes (such as BRCA genes) that run in certain families and can significantly increase risk. If necessary, genetic counselling may result in further genetic testing.

You can also talk with your doctor or nurse practitioner to make an informed choice about breast cancer screening. There may be a delay in booking your screening appointment due to COVID-19. To find out more about the Ontario Breast Screening Program please visit cancerontario.ca/obsp.

525 University Avenue, 5th Floor, Toronto ON, M5G 1L3 | Version Date: September 18, 2020

Your Risk Level: Average/Higher than Average/High

In Canada, about <number> out of 1000 women your age may develop breast cancer over the next 10 years.

Your risk for developing breast cancer is about <same/higher/much higher> as most Canadian women your age.

In this risk level, up to/between/more than <number> out of 1000 women your age may get breast cancer over the next 10 years.

Understanding Your Assessment

Understanding your assessment



 **PERSPECTIVE**
INTEGRATION & IMPLEMENTATION

 **Ontario Health**
Cancer Care Ontario

Understanding your breast cancer risk assessment

Now that you have your breast cancer risk assessment results, you can learn how we estimated your personal risk level.



Why are we doing this study?

In this study, we are working to find ways to identify women more likely to get breast cancer using a new computer risk assessment tool. This tool can estimate your risk level by using information about your genetic makeup and other risk factors. Genetic makeup was assessed using a new breast cancer genetic test. The purpose of this study is to understand the benefits and harms of knowing your breast cancer risk level and how this information can be used by women like you to make an informed choice about breast cancer screening.

Find out more

My CancerIQ
mycanceriq.ca

Complete a breast cancer risk assessment and get a personalized prevention action plan.

Breast Cancer Screening
cancercareontario.ca/breast

Helpful information about being screened for breast cancer in Ontario.

Ontario Breast Screening Program (OBSP)

cancercareontario.ca/obsp

Locations and contact:
cancercareontario.ca/obsplocations

Women at high risk:
cancercareontario.ca/highriskobsp

Understanding Your Assessment

How did we estimate your risk?

Your risk was estimated using information from your questionnaire, genetic test and mammogram report.

Step 1

As part of the Personalized Risk Assessment for Prevention and Early Detection of Breast Cancer Integration and Implementation (PERSPECTIVE) study, you were asked to complete a questionnaire, to provide a saliva sample and to give permission to collect your most recent mammogram report.

The questionnaire asked you about your general background, family history of cancer, screening practices and lifestyle habits. It also asked what you think about your breast cancer risk and having genetic tests.

You sent us a saliva sample using a collection kit to provide a source of DNA for the breast cancer genetic test. Your recent mammogram report provided a measurement of your breast density.

Step 2

We entered the information you gave us into a risk assessment tool called BOADICEA (Breast and Ovarian Analysis of Disease Incidence and Carrier Estimation Algorithm) to estimate your risk level.

Information from your questionnaire, genetic test and mammogram report were entered into BOADICEA to estimate whether your risk level of getting breast cancer is average, higher than average or high.

Step 3

Your risk level was estimated based on the information entered into the tool.

Questionnaire

We used your answers to questions on risk factors and family history of cancer.

Breast Cancer Genetic Test

We estimated your risk score based on variations in your genes that are commonly found in other people that may affect breast cancer risk. This test does not check for rare genetic mutations (permanently change in DNA) that run in certain families and can significantly increase risk.

Mammogram Report

We used the breast density measured on your recent mammogram. A breast is considered dense when it has a lot of glandular tissue (ducts, glands for producing milk and supportive tissue) compared to fatty tissue.

Limitation

The results of your risk assessment are based on the information you gave us at the time. If you think your breast cancer risk level has changed since then, you should talk to your doctor or nurse practitioner.

What can you do to reduce your risk?

Here is some information and steps you can take to reduce your risk. It is important to understand the risk factors.

Know your breast cancer risk factors

The chance of getting breast cancer is not the same for all women. Some women have a higher risk and some have a lower risk. There are factors that can help lower your risk of breast cancer and factors that may increase your risk.

Factors that you can change or control:

- There is no safe limit of alcohol use. Each alcoholic drink increases risk.
- Gaining body fat as an adult may increase several hormones and risk.
- Taking oral contraceptives (birth control pills) or hormone replacement therapy may increase risk.
- Being physically active may control hormones and lower risk.

Factors that you cannot change or control:

- Some types of benign breast disease (that are not cancer) may increase risk.
- Genetic mutations that run in certain families can significantly increase risk. But breast risk affecting specific genes such as BRCA genes, and occur in less than 1% of the population.
- Having first degree blood relatives (mother, father, sister, brother or child) diagnosed with breast cancer, especially if the cancer was diagnosed at a young age, may double risk.

- Women of Eastern European or German Jewish descent are more likely to have genetic changes that can increase risk.
- Lifetime exposure to hormones, especially estrogen, can encourage the growth of some types of breast cancers. Risk is lower if you start menstruating at a later age or go through menopause at an earlier age.
- Having children, particularly at an earlier age or having several children, lowers risk.
- Receiving ionizing radiation therapy to the chest before age 30 and at least 8 years ago increases risk.
- Tall women may have a higher risk.
- Being heavier than average at birth (usually defined as weighing more than 8.5 pounds) may slightly increase risk before menopause.
- Having dense breasts increases risk. A breast is considered dense when it has a lot of glandular tissue (ducts, glands for producing milk and supportive tissue) compared to fatty tissue. Breast density can be measured on a mammogram.

What steps can you take?

Whether you have an average, higher than average or high risk level, it is always helpful to know what choices you can make.

Screening:

Regular breast cancer screening can help to find cancer early when it may be smaller and easier to treat. Use your risk level (average, higher than average, high) and screening action plan to make an informed choice.

Regardless of your age or risk factors, if you notice changes in your breasts or have concerns, you should see your doctor or nurse practitioner. Most changes are non-cancerous, but should be checked right away. Contact your doctor if you notice:

- A lump or lumping
- Changes in the nipple or fluid leaking from the nipple
- Skin changes or redness that do not go away, or
- Any other changes in your breasts

Prevention:

If you take hormonal therapy, talk with your doctor or nurse practitioner. The artificial hormones in oral contraceptives (birth control pills) and hormone replacement therapy may increase your risk of breast cancer.

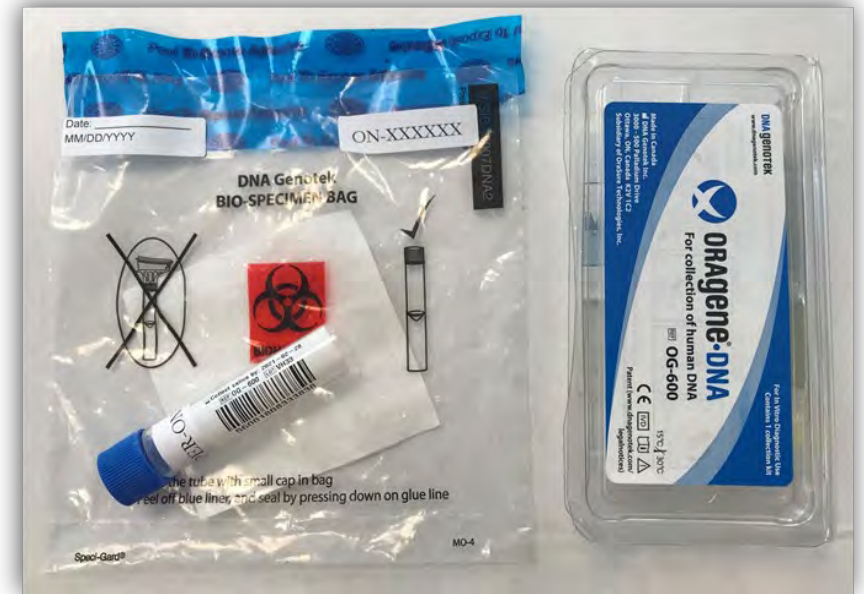
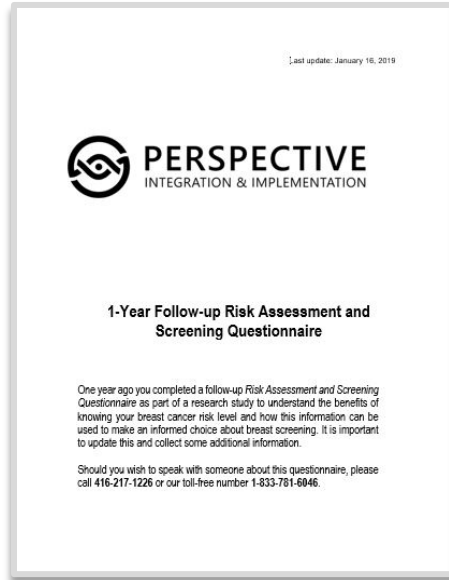
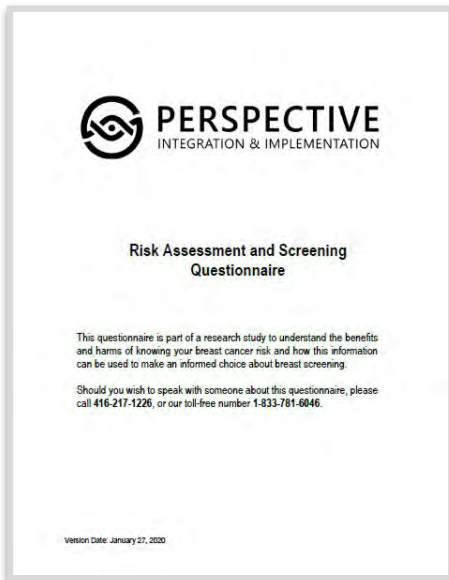
Limit the amount of alcohol you drink. Research suggests that when it comes to breast cancer, there is no safe level of drinking to reduce your risk of breast cancer; you may want to stop drinking or drink less.

Maintain a healthy body weight. Excess body fat can increase the risk of breast cancer after menopause. Small changes in diet and physical activity can lead to a modest weight loss and a lower breast cancer risk. Making small but consistent changes is a lot easier – and is more likely to lead to long-term success – than going on an extreme diet or weight loss plan.

Being physically active can reduce your risk of developing a number of serious diseases, including breast and colorectal cancer, heart disease and diabetes. It can also help you maintain a healthy weight, relieve stress and improve mood. Health Canada recommends that adults be moderately to vigorously active for at least 2.5 hours (150 minutes) a week.

You can visit My CancerIQ to get your personalized prevention action plan. However, your risk level estimated by My CancerIQ may differ from risk study, as we also used your genetic test result and breast density.



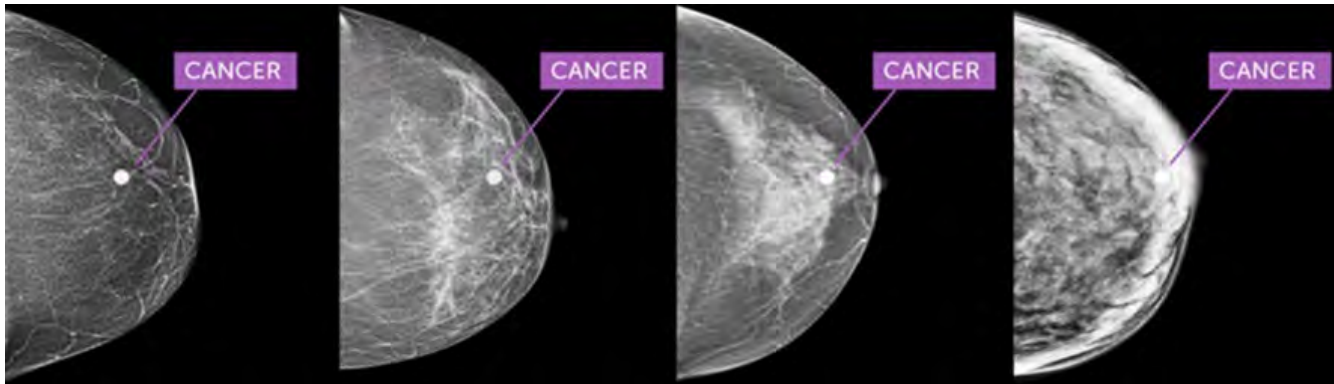


Almost entirely fatty

Scattered fibroglandular

Heterogeneously Dense

Extremely Dense



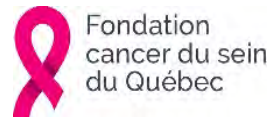
PRS: BCGR SNP test ~300 SNPs

- Next generation sequencing of SNPs
- Clinical grade
- Standard operating procedures
- Assay designed for high volume/low-cost

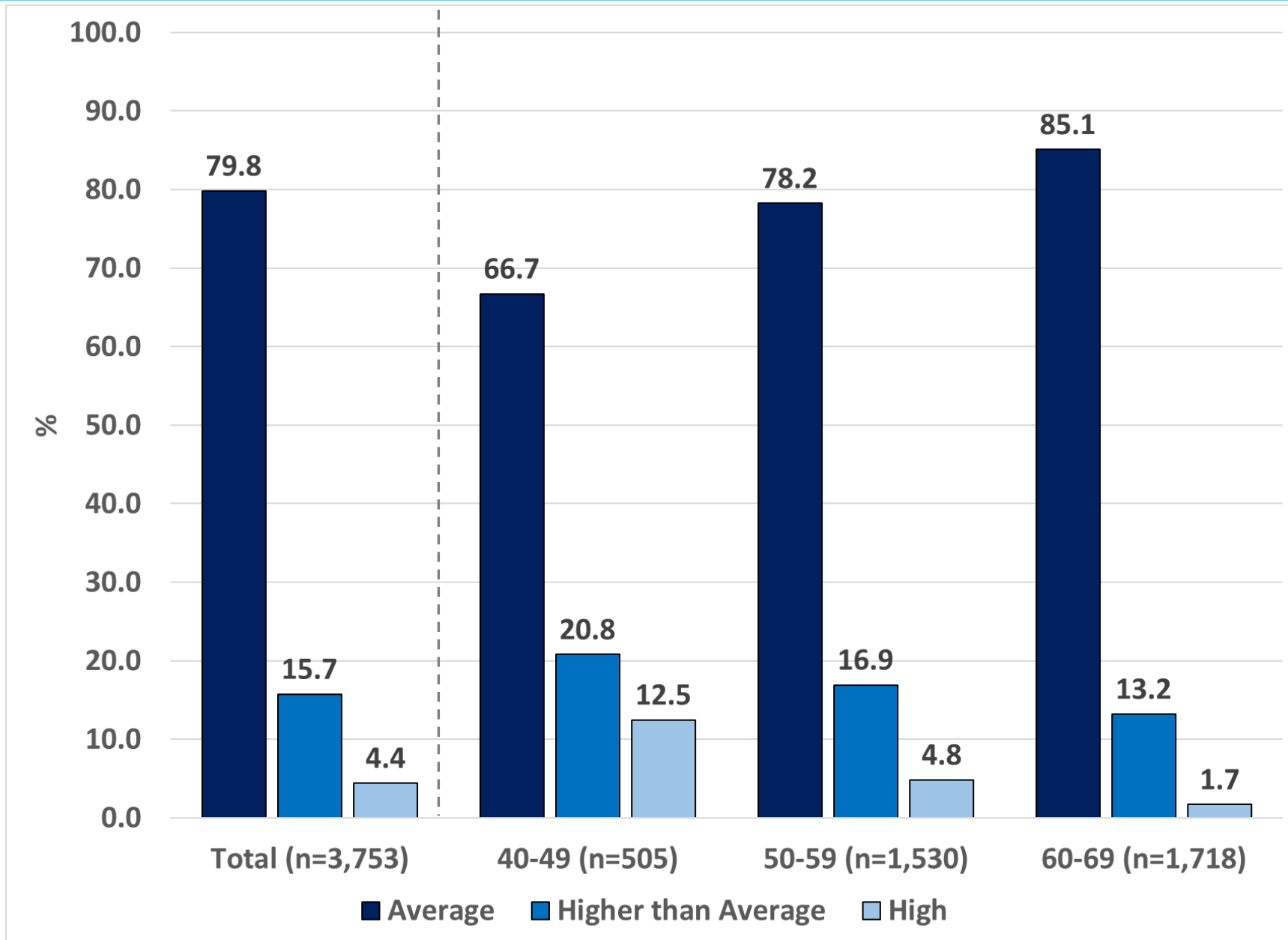


Activity 3

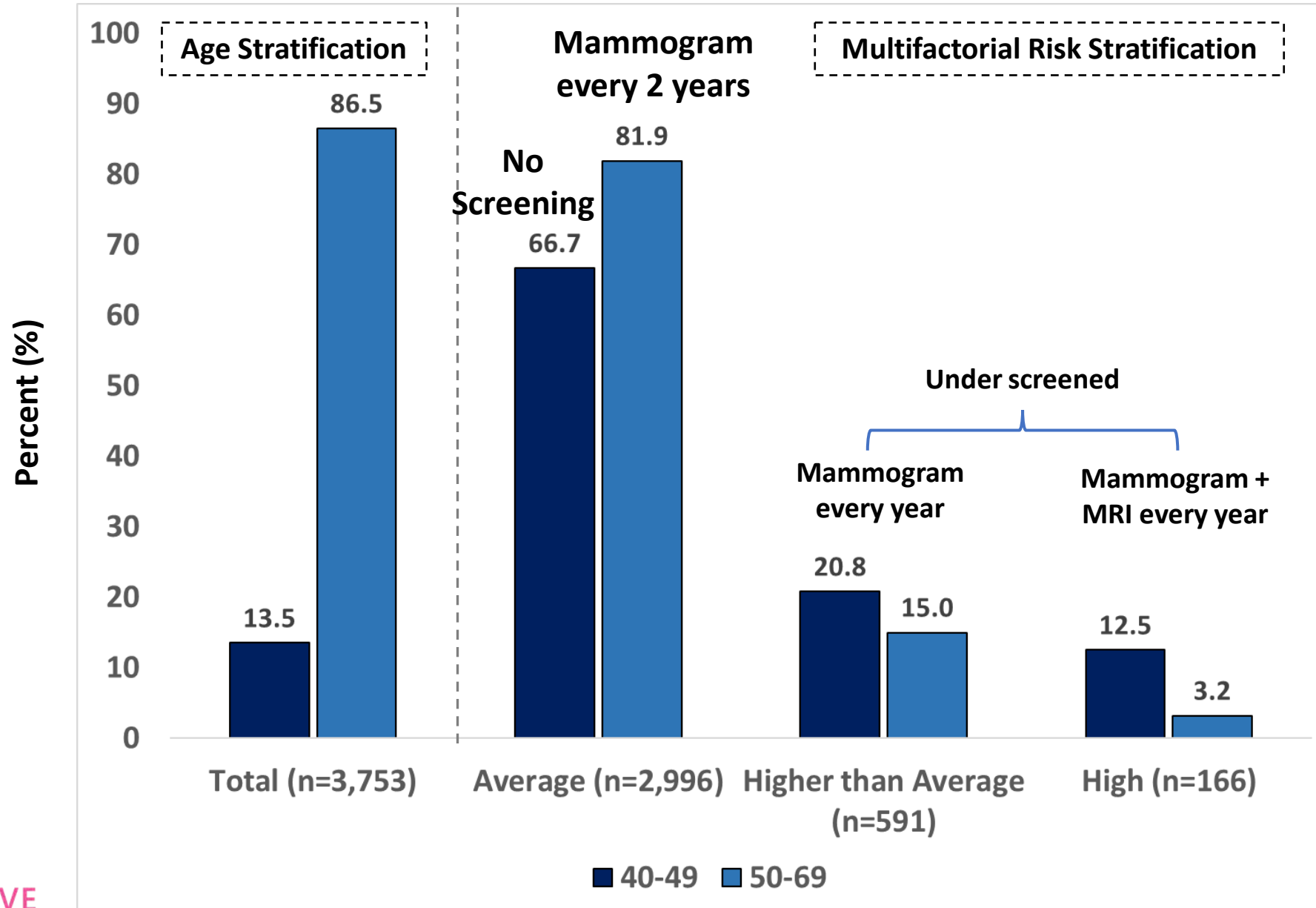
Early Results



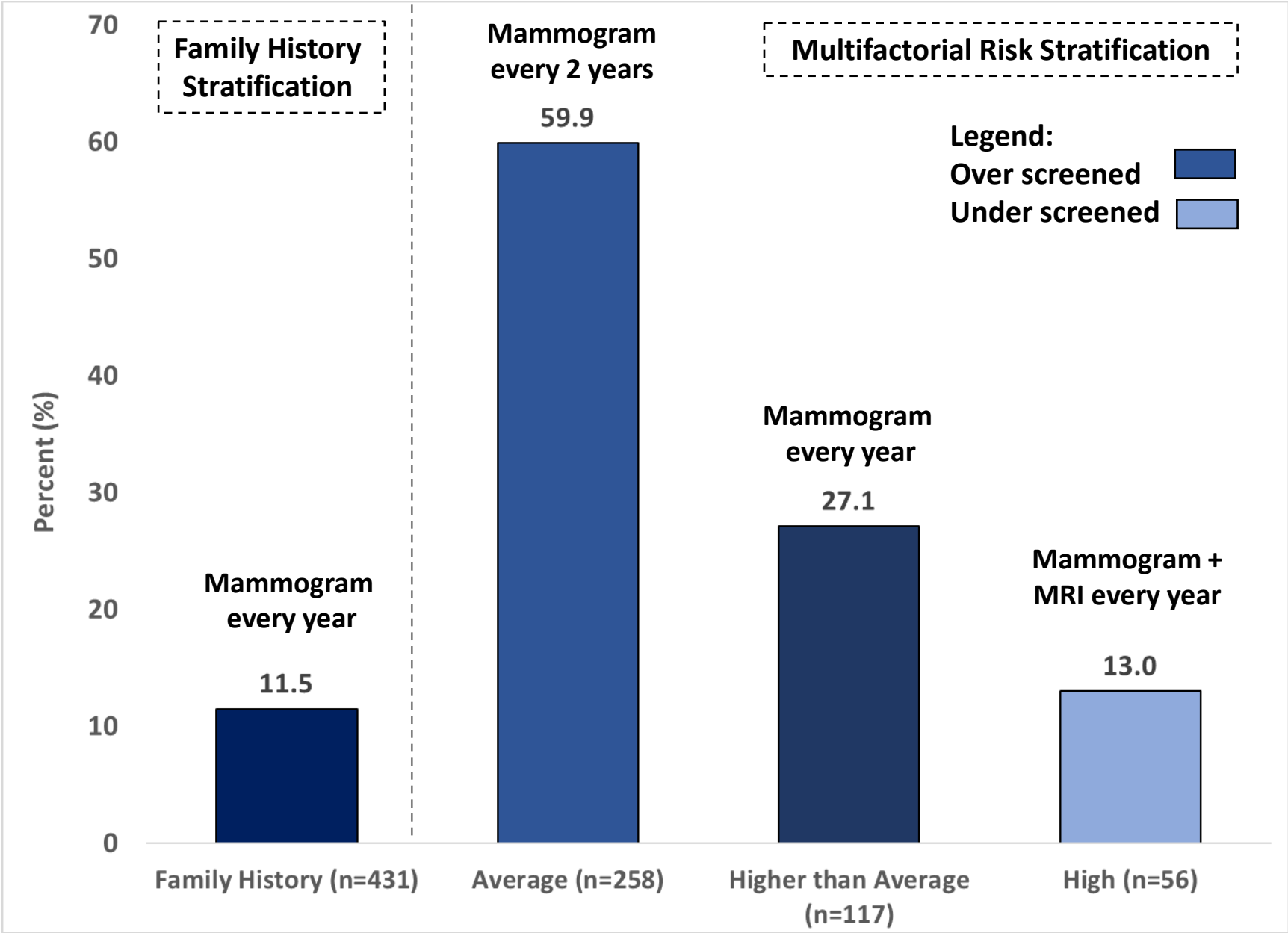
Breast Cancer Risk Level by Age Group (n=3,753)



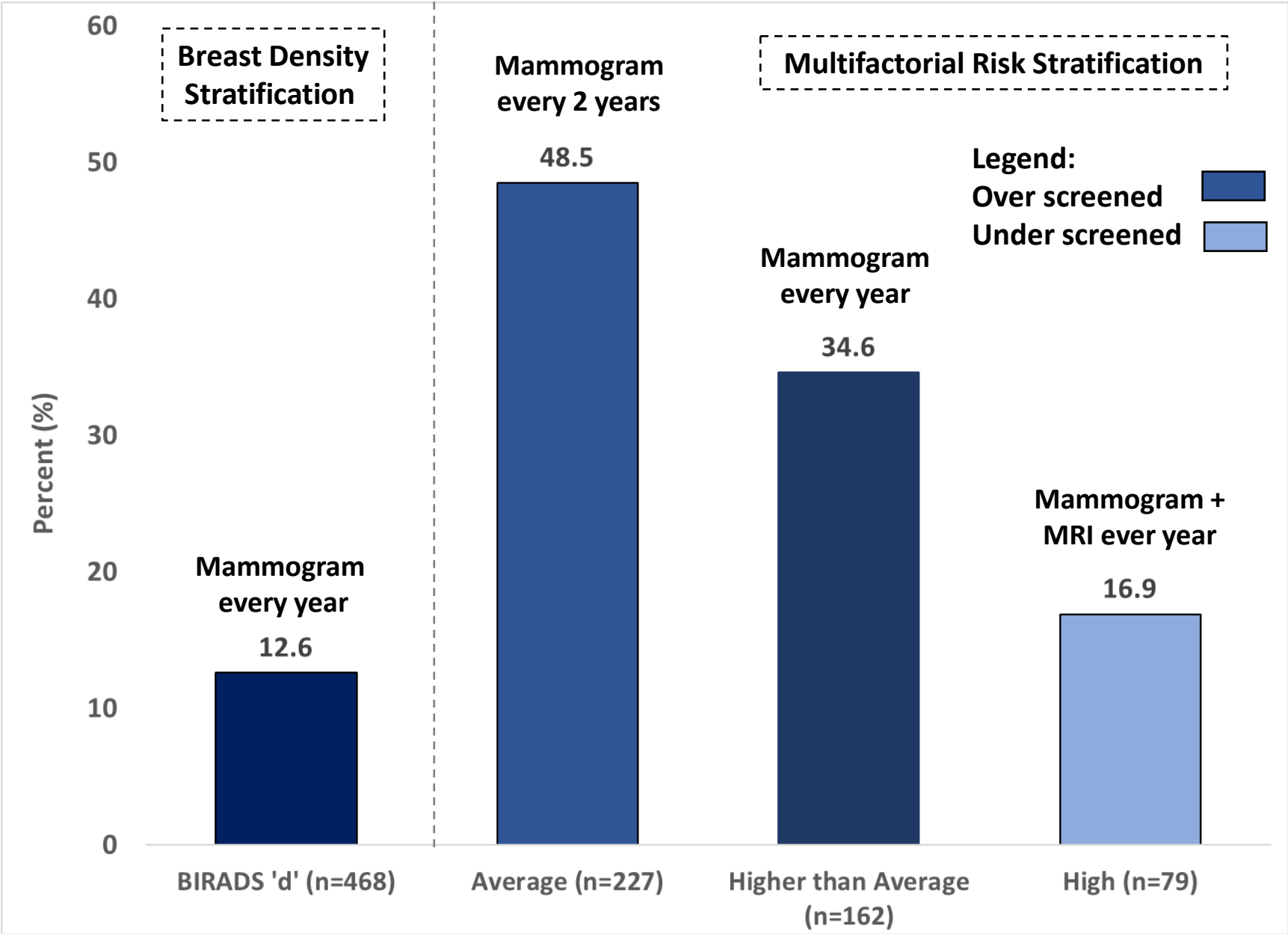
Screening Recommendation by age and risk level stratification (n=3,753)



Screening recommendation by family history and risk level stratification

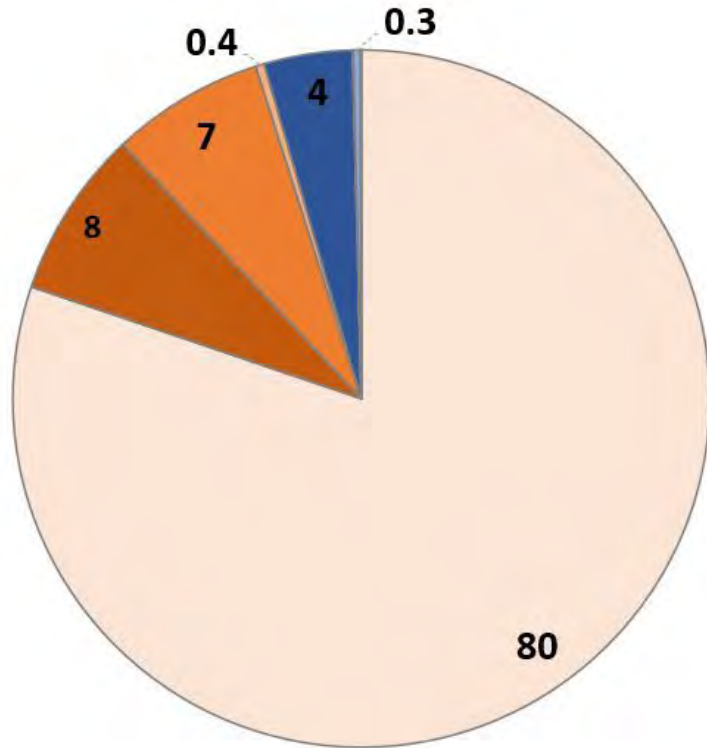


Screening recommendation by BIRADS Density 'D' vs. risk level stratification

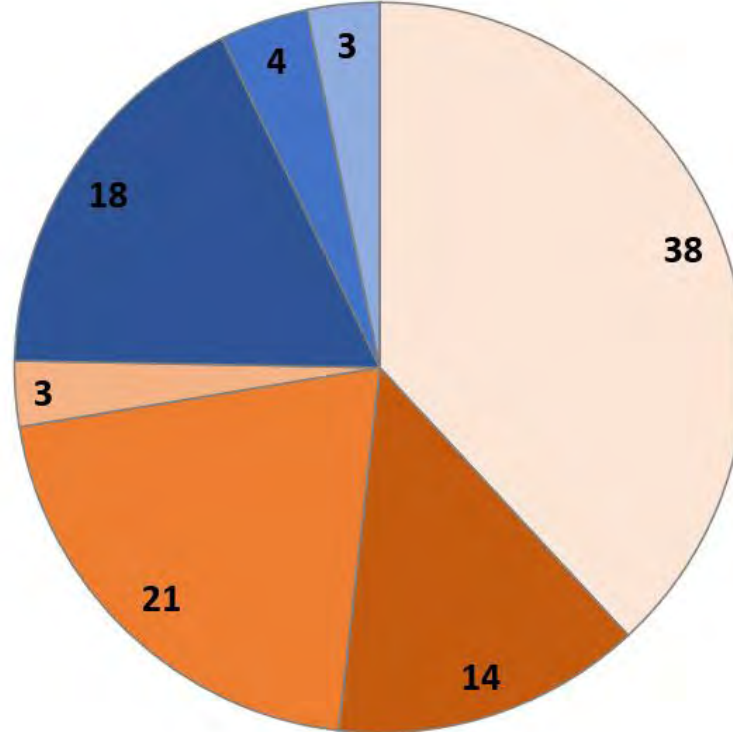


Contribution of family history, breast density, and PRS using multifactorial risk prediction by risk level (N=3,753)

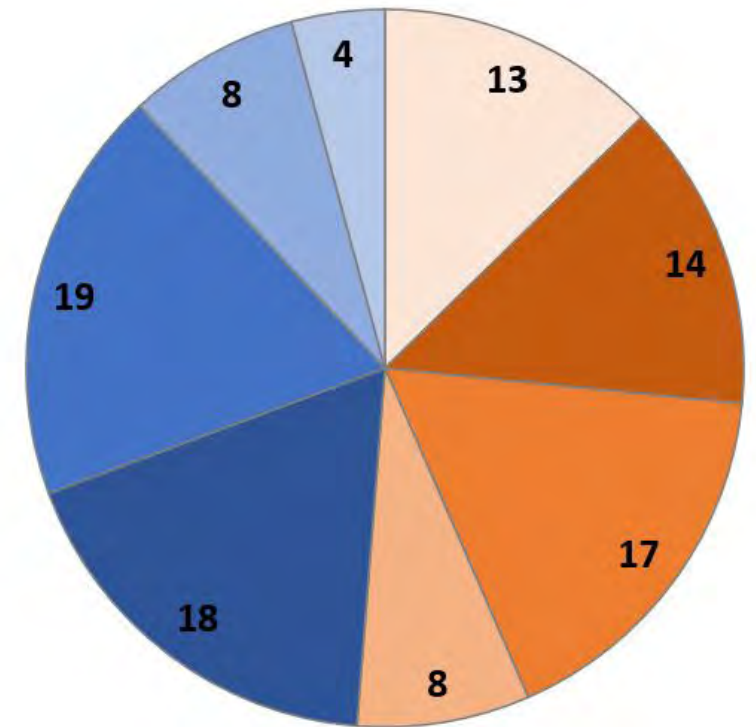
Average n=2,996 (79.8%)



Higher than Average n=591 (15.7%)

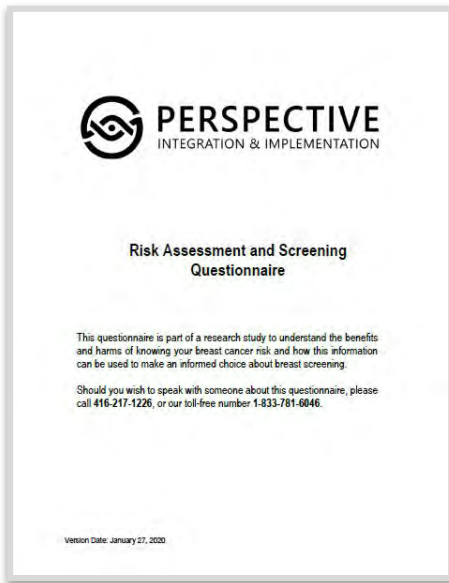


High n=166 (4.4%)

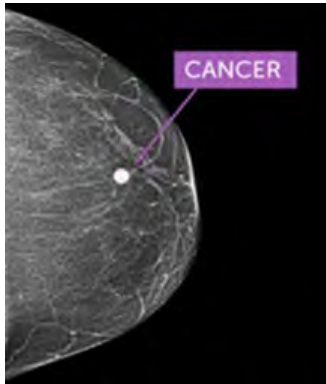


- None of these 3 risk factors
- Family history
- High breast density
- Family history and high breast density
- High PRS
- High PRS and high breast density
- High PRS and family history
- High PRS, high breast density and family history

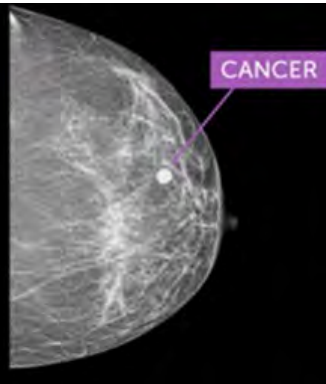
Follow-up....



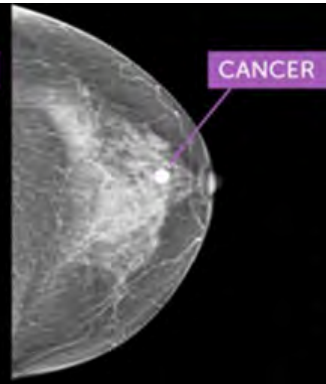
Almost entirely fatty



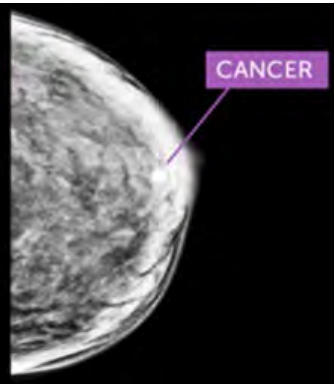
Scattered fibroglandular



Heterogeneously Dense



Extremely Dense



- Opinions of mammography
- Acceptability of risk-based screening
- Behaviour change
- Risk perception
- Anxiety

Beliefs about advantages of risk prediction (Q1 & Q2 & Q3)

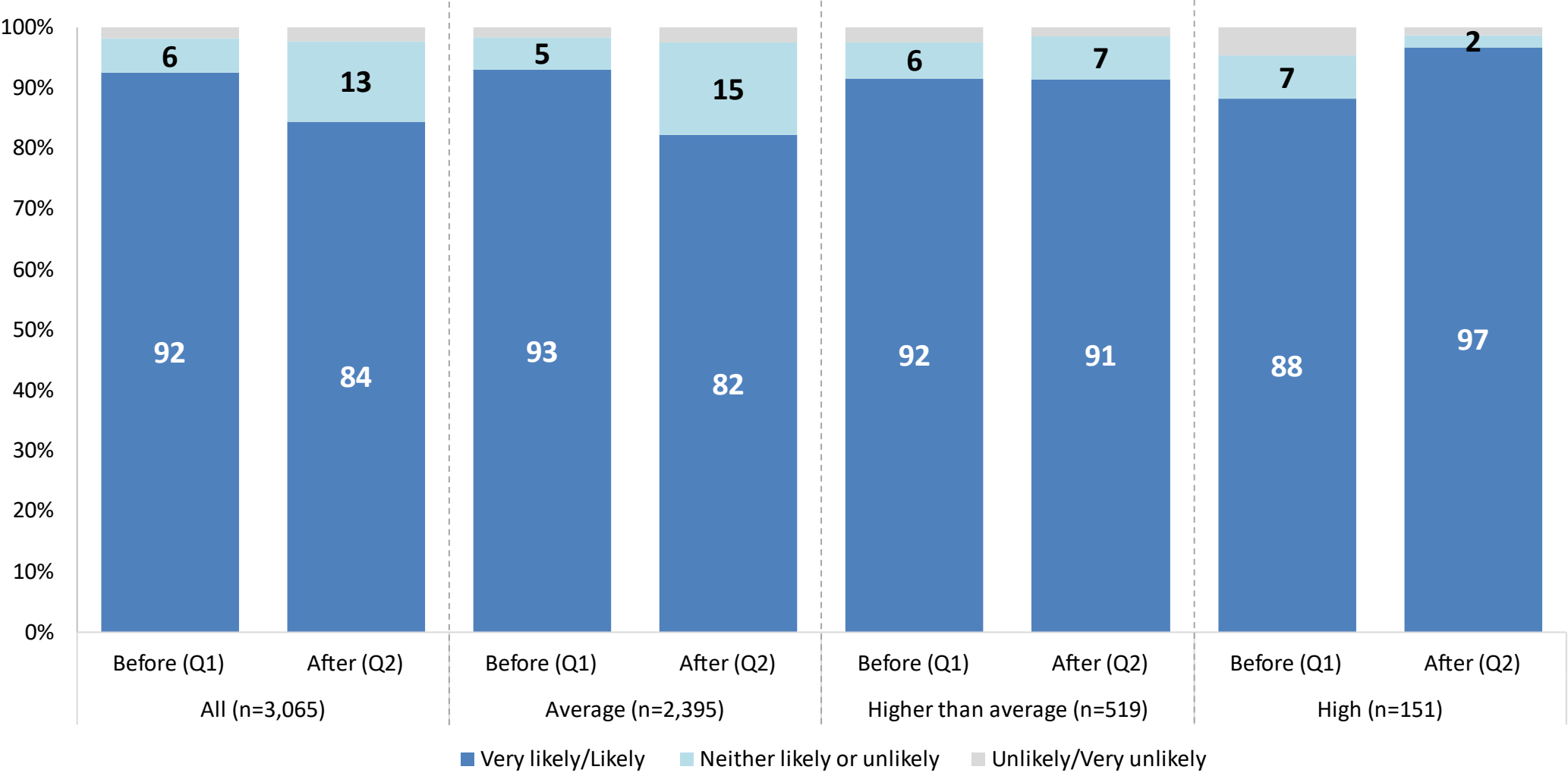
Below are statements of some potential advantages of knowing your breast cancer risk. For each of the statements below, please check the one answer that best describes to what extent it is an advantage to you.

	Very likely to be an advantage	Likely to be an advantage	Neither likely or unlikely to be an advantage	Unlikely to be an advantage	Very unlikely to be an advantage
To gain more knowledge about my health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To ease my worry about breast cancer risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To inform my family about breast cancer risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To know how to plan for the future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To help make decisions about lifestyle changes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To help make decisions about breast cancer screening	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To know what symptoms should be taken seriously	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Source: Jacobsen 1997, Rainey 2018

**Before and after risk communication (Q1 & Q2):
Beliefs about advantages of risk-based screening by risk level (n=3,065)**

Advantage: Helping to make decisions about breast cancer screening



Beliefs about disadvantages of risk prediction (Q1 & Q2 & Q3)

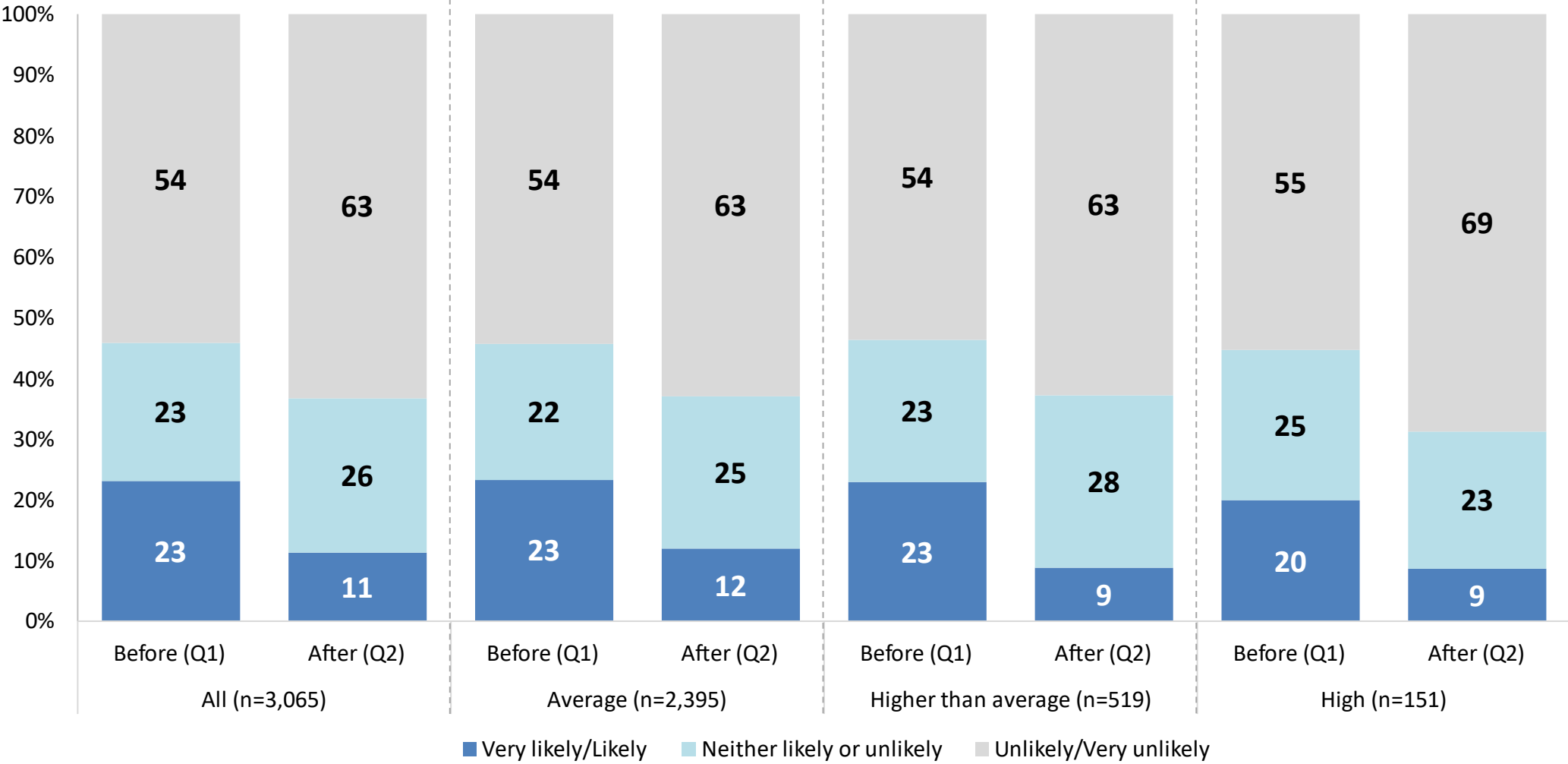
Below are statements of some potential disadvantages of knowing your breast cancer risk. For each of the statements below, please check the one answer that best describes to what extent it is a disadvantage to you.

	Very likely to be a disadvantage	Likely to be a disadvantage	Neither likely or unlikely to be a disadvantage	Unlikely to be a disadvantage	Very unlikely to be a disadvantage
Getting information that could cause worry about the future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting information that I don't want to know	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting information that could leave me feeling helpless	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting complicated information that I won't understand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting information that could cause worry in my family	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

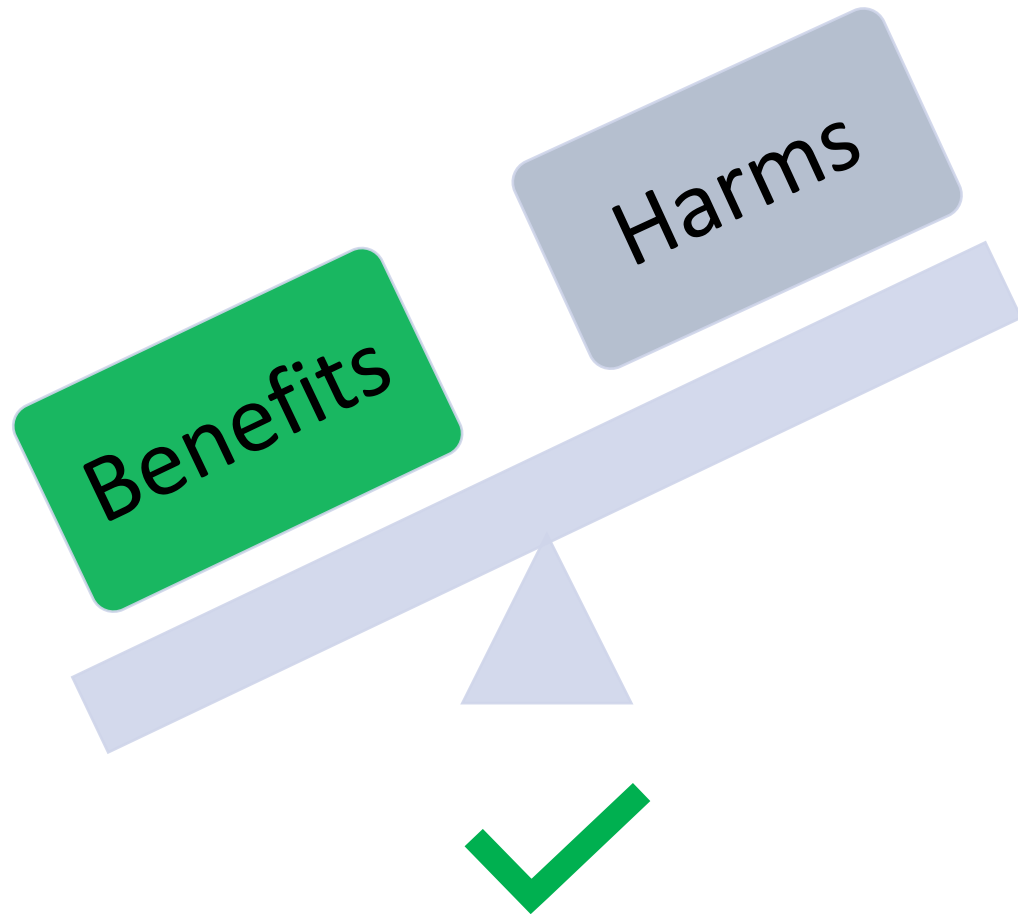
Source: Jacobsen 1997, Rainey 2018

**Before and after risk communication (Q1 & Q2):
Beliefs about disadvantage of risk-based screening by risk level (n=3,065)**

Disadvantage: Receiving information that I don't want to know



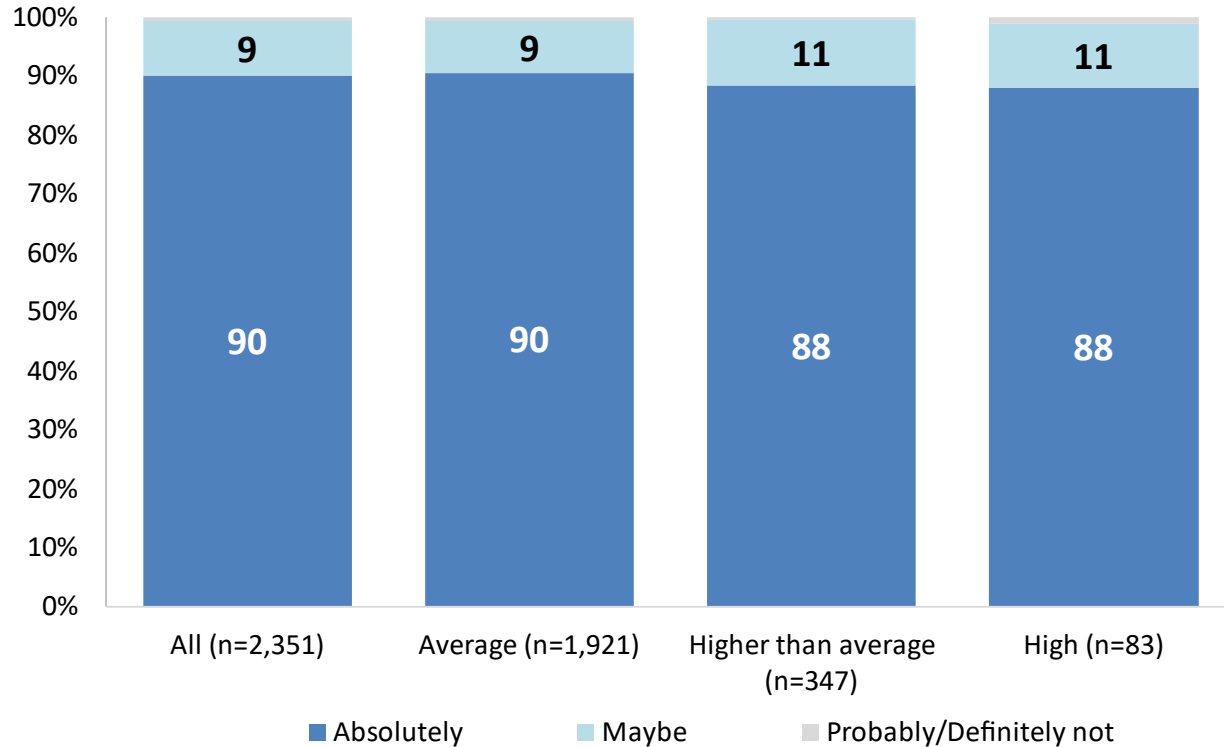
Overall Perception



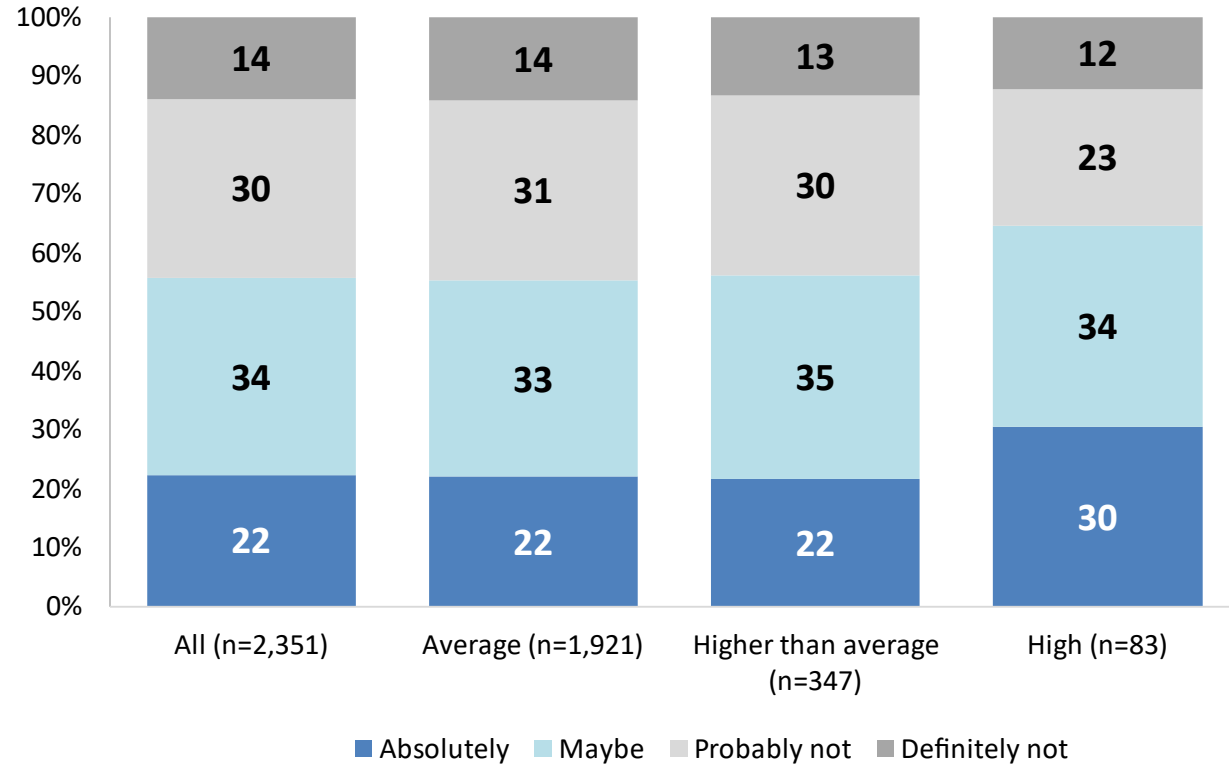
BUT...

Before risk communication (Q1 & Q3): Acceptability for risk-based screening by risk level (n=2,351*)

If your estimated breast cancer risk was found to be **higher than average**, would you be willing to have your mammogram **more often than you usually have**?



If your estimated breast cancer risk was found to be **much lower than average**, would you be willing to have your mammogram **less often than you usually have**?












*excludes those who were screened every year or less



Article

Women's Views on Multifactorial Breast Cancer Risk Assessment and Risk-Stratified Screening: A Population-Based Survey from Four Provinces in Canada

Cynthia Mbuya-Bienge ^{1,2}, Nora Pashayan ³ , Jennifer D. Brooks ⁴, Michel Dorval ^{1,5,6} , Jocelyne Chiquette ^{1,7,8}, Laurence Eloy ⁹, Annie Turgeon ¹, Laurence Lambert-Côté ¹, Jean-Sébastien Paquette ⁸ , Emmanuelle Lévesque ¹⁰ , Julie Hagan ¹⁰ , Meghan J. Walker ^{4,11}, Julie Lapointe ¹, Gratien Dalpé ¹⁰ , Palmira Granados Moreno ¹⁰ , Kristina Blackmore ¹¹, Michael Wolfson ¹², Yann Joly ¹⁰, Mireille Broeders ^{13,14} , Bartha M. Knoppers ¹⁰ , Anna M. Chiarelli ^{4,11}, Jacques Simard ^{1,15}, Hermann Nabi ^{1,2,16,*}
and The PERSPECTIVE I&I Study Group [†]

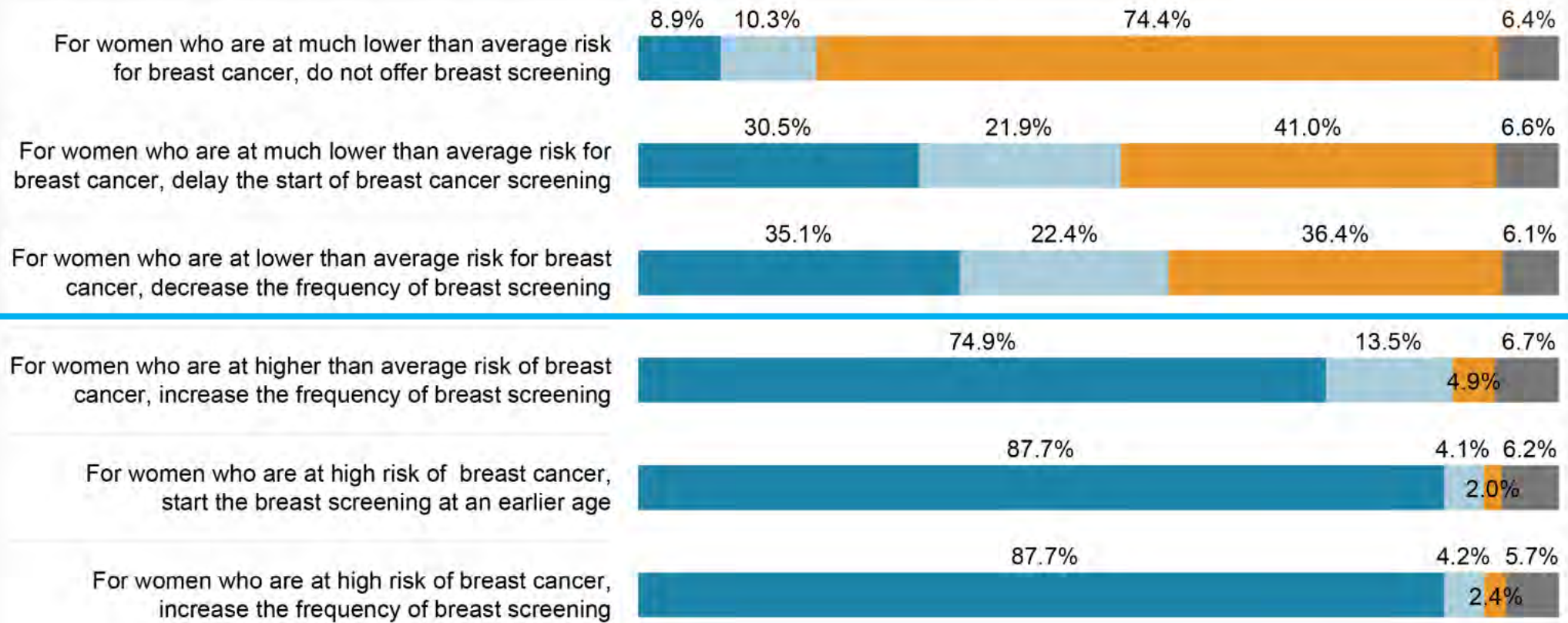
Article

Canadian Healthcare Professionals' Views and Attitudes toward Risk-Stratified Breast Cancer Screening

Julie Lapointe ¹, Jean-Martin Côté ¹, Cynthia Mbuya-Bienge ^{1,2}, Michel Dorval ^{1,3,4} , Nora Pashayan ⁵ ,
Jocelyne Chiquette ^{1,6}, Laurence Eloy ⁷, Annie Turgeon ¹, Laurence Lambert-Côté ¹ , Jennifer D. Brooks ⁸ ,
Meghan J. Walker ^{8,9}, Kristina Maria Blackmore ⁹, Yann Joly ^{10,11}, Bartha Maria Knoppers ¹⁰ ,
Anna Maria Chiarelli ^{8,9}, Jacques Simard ^{1,12}  and Hermann Nabi ^{1,2,*} 



Figure 1. Healthcare professionals' attitudes regarding possible breast cancer (BC) screening recommendations related to different risk categories (N = 593).



Legend

- Agree to strongly agree
- Neither agree or disagree
- Disagree to strongly disagree
- Missing



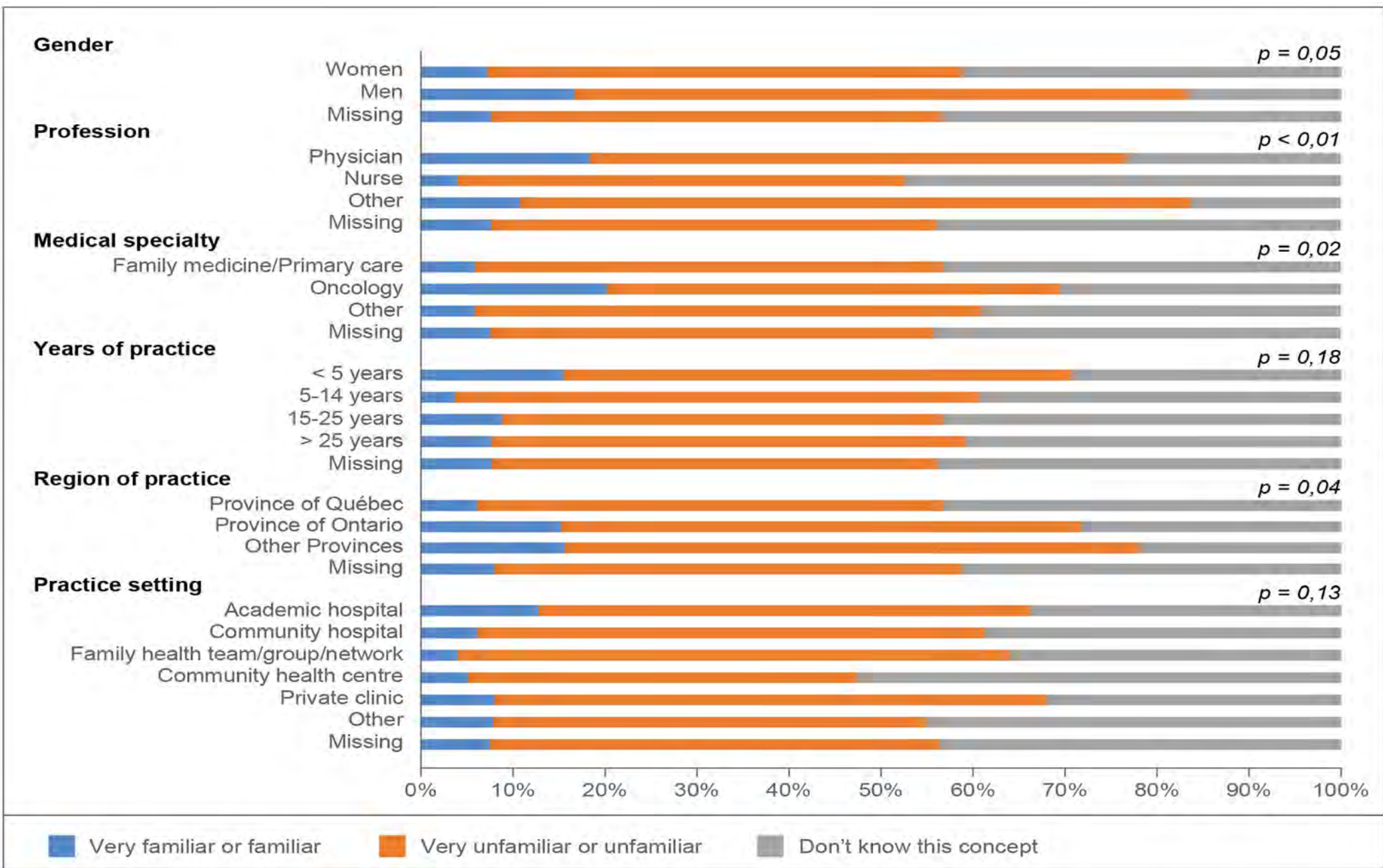
ELSEVIER

ARTICLE

Polygenic risk scores and risk-stratified breast cancer screening: Familiarity and perspectives of health care professionals



Julie Lapointe¹, Anne-Catherine Buron¹, Cynthia Mbuya-Bienge^{1,2}, Michel Dorval^{1,3,4},
Nora Pashayan⁵, Jennifer D. Brooks⁶, Meghan J. Walker^{6,7}, Jocelyne Chiquette^{1,8},
Laurence Eloy⁹, Kristina Blackmore⁷, Annie Turgeon¹, Laurence Lambert-Côté¹,
Lucas Leclerc¹, Gratien Dalpé¹⁰, Yann Joly^{10,11}, Bartha Maria Knoppers¹⁰,
Anna Maria Chiarelli^{6,7}, Jacques Simard^{1,12}, Hermann Nabi^{1,2,*} 



Activity 3

Next Steps/On-Going Work

Main Deliverables

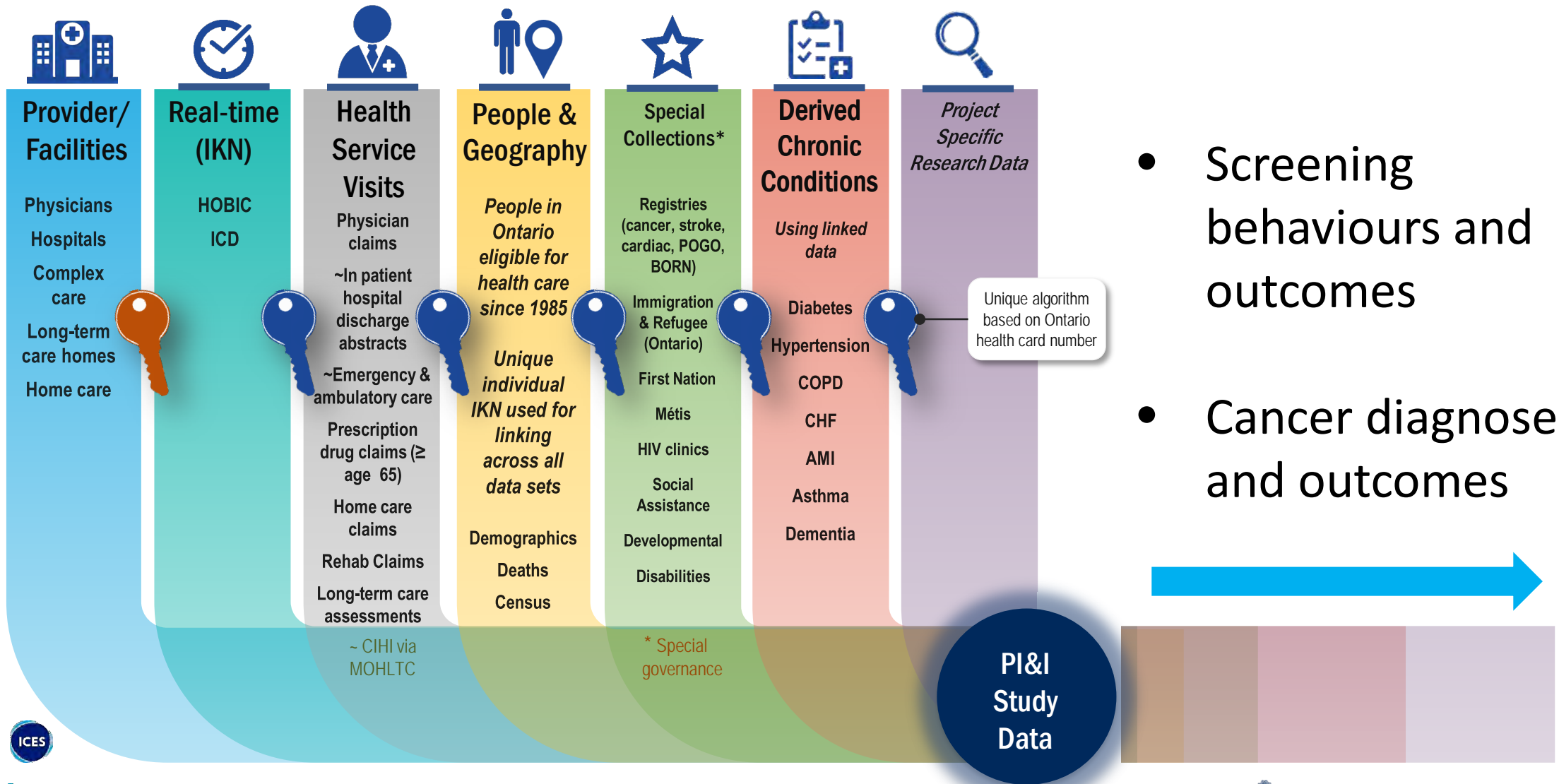
Risk-based Screening Implementation Framework

- Development of a standardized approach and assurance for early knowledge transfer to identify individuals most likely to benefit

Valuable Prospective Cohort

- Examine screening outcomes (cancer detection rate, false positives, early-stage invasive cancer), screening behaviours and psychosocial outcomes
- Potential to examine long-term outcomes and further testing on bio-banked material from saliva
- Linkage to administrative health data

Ontario Administrative Health Data



- Screening behaviours and outcomes
- Cancer diagnoses and outcomes

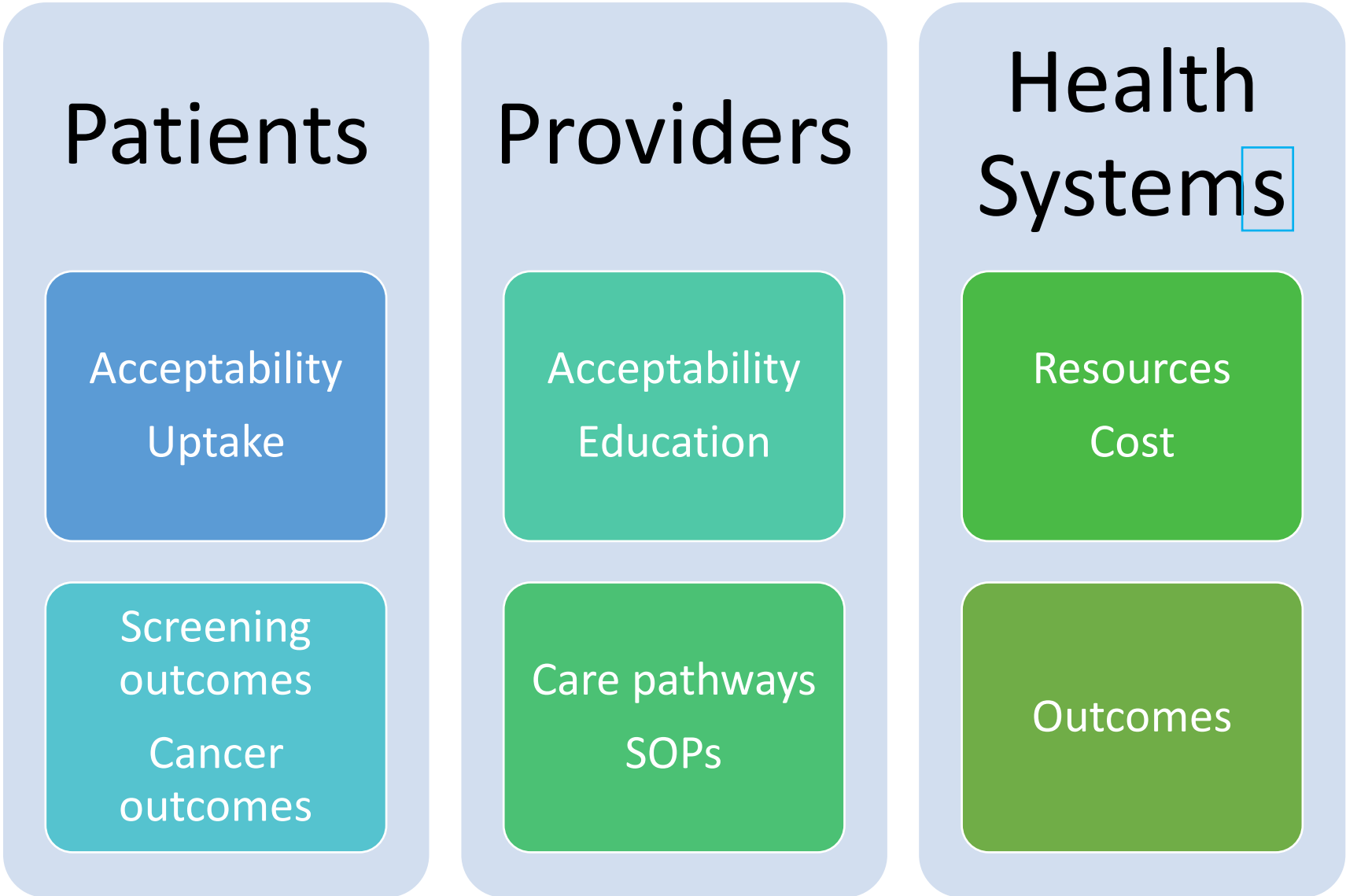
Economic Evaluation (Nicole Mittman and Michael Wolfson)

INPUTS

OUTPUTS



Summary



Summary

- **Multifactorial risk levels compared to age, family history or breast density alone** can provide more appropriate recommendations by **reducing over screening (50 - 60%)** in those at **average risk** and **increasing screening frequency or additional imaging (13 - 33%)** for those at **higher risk**
- The addition of **polygenic risk scores with breast density and/or family history** improves risk stratification
- **Multifactorial risk stratification** may better inform **risk-based screening** recommendations

Summary

- **Women see the benefit** – but are not necessarily willing to accept less screening
- **Implementation will require significant training** and the development of new pathways of care
- **Engagement with:**
 - Decision makers (e.g., government agencies, Ministry of Health)
 - Those who administer screening program (e.g., regional coordinating centres, screening sites)
 - Those who deliver screening program (e.g., family physicians, radiologists, radiographers)
 - Ongoing work led by Dr. Nora Pashayan



Jacques Simard
Project Leader

PERSONALIZED RISK ASSESSMENT FOR PREVENTION AND EARLY DETECTION OF BREAST CANCER: INTEGRATION & IMPLEMENTATION



Anna Maria Chiarelli
Co-Project Leader

GENETIC EPIDEMIOLOGY, BIostatISTICS & BIOINFORMATICS



Douglas Easton



Antonis Antoniou



David Goldgar



Peter Kraft



Arnaud Droit



Bingjian Feng

GENOMICS, MOLECULAR GENETICS & BIOLOGY



Jean-Yves Masson



Sean Tavtigian



Irene Andrulis



Alvaro Monteiro



Haico van Attikum



Amanda Spurdle

HEALTH ECONOMICS



Nicole Mittmann



Michael Wolfson

ETHICS, LAW & SOCIETY



Bartha M. Knoppers



Yann Joly

EPIDEMIOLOGY & PUBLIC HEALTH



Michel Dorval



Meghan Walker



Jennifer Brooks



Nora Pashayan



Mireille Broeders



Montse Garcia-Closas



Hermann Nabi

CLINICAL ONCOLOGY, MEDICAL GENETICS & PRIMARY CARE



Jocelyne Chiquette



Laurence Eloy



Andrea Eisen



Rita Schmutzler



Gareth Evans

MOLECULAR DIAGNOSTICS



Suzanne Kamel-Reid



Tracy Stockley



Peter Devilee



Eric Hahnen

