

Table S1. 52-genes included in this study.

Gene	Reference sequence
APC	NM_000038
ATM	NM_000051
ATR	NM_001184
AXIN2	NM_004655
BAP1	NM_004656
BARD1	NM_000465
BLM	NM_000057
BMPR1A	NM_004329
BRCA1*	NM_007294
BRCA2*	NM_000059
BRIP1 *	NM_032043
CDH1	NM_004360
CDK4	NM_000075
CDKN2A (p14ARF, p16INK4a)	NM_000077, NM_058195
CHEK2*	NM_007194
EPCAM*	NM_002354
FAM175A	NM_139076
FANCA	NM_000135
FANCL	NM_001114636
FANCM	NM_020937
GALNT12	NM_024642
GEN1	NM_001130009
HOXB13:c.251G>A p.(G84E)	NM_006361
MEN1	NM_000244
MITF	NM_001354604
MLH1*	NM_000249
MRE11	NM_005591
MSH2*	NM_000251
MSH3	NM_002439
MSH6*	NM_000179
MUTYH*	NM_001128425
NBN	NM_002485
NF1	NM_000267
NTHL1	NM_002528
PALB2*	NM_024675
PMS2	NM_000535
POLD1 (Exons 8-13)	NM_001256849
POLE (Exons 1-14)	NM_006231
PPP2R2A	NM_002717
PTEN	NM_000314
RAD50*	NM_005732
RAD51B	NM_133509
RAD51C*	NM_058216
RAD51D*	NM_002878
RET	NM_020975
RNF43	NM_017763
RPS20	NM_001023
SMAD4	NM_005359
SMARCA4	NM_001128849
STK11	NM_000455
TP53*	NM_000546
VHL	NM_000551

*Copy number variation analysis was performed on the following genes:

BRCA1, BRCA2, CHEK2, EPCAM (Exons 8, 9), MLH1, MSH2, MSH6, MUTYH, PALB2, RAD50 (Exons 1, 2, 4, 10, 14, 21, 23 and 25), RAD51C, RAD51D, and TP53.

Table S2. Breast cancer associated genes and risk category.

Gene	Risk category (Absolute risk)	Risk evidence
<i>ATM</i>	Moderate (20%–30%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>BARD1</i>	Moderate (17%–30%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>BLM</i>	Unspecified	PMID: 31614901, 20301572
<i>BRCA1</i>	High (>60%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>BRCA2</i>	High (>60%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>BRIP1</i>	Unspecified	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>CDH1</i>	High (41%–60%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>CHEK2</i>	Moderate (20%–40%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>EPCAM</i>	Low (<15%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>FAM175A</i>	Uncertain	PMID: 35353237, 22357538
<i>FANCA</i>	Uncertain	PMID:32235514
<i>FANCL</i>	Uncertain	PMID:32235514
<i>FANCM</i>	Uncertain	PMID:32235514
<i>MLH1</i>	Low (<15%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>MRE11</i>	Unspecified	PMID: 23586058
<i>MSH2</i>	Low (<15%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>MSH6</i>	Low (<15%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>NBN</i>	Unspecified	PMID: 33471991
<i>NF1</i>	Moderate (20%–40%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>NTHL1</i>	Unspecified	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Colorectal, Version 1.2023
<i>PALB2</i>	High (41%–60%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>PMS2</i>	Low (<15%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>PTEN</i>	High (40%–60%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>RAD50</i>	Unspecified	PMID: 21356067
<i>RAD51C</i>	Moderate (17%–30%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>RAD51D</i>	Moderate (17%–30%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>SMARCA4</i>	Unspecified	PMID: 21356067
<i>STK11</i>	High (32%–54%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024
<i>TP53</i>	High (>60%)	NCCN Guidelines®, Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, Version 1.2024