# The risk of cardiac disease in Korean breast cancer patients: Impact of patient-specific factors and heart dose based on individual heart dose calculation from three-dimensional RT planning

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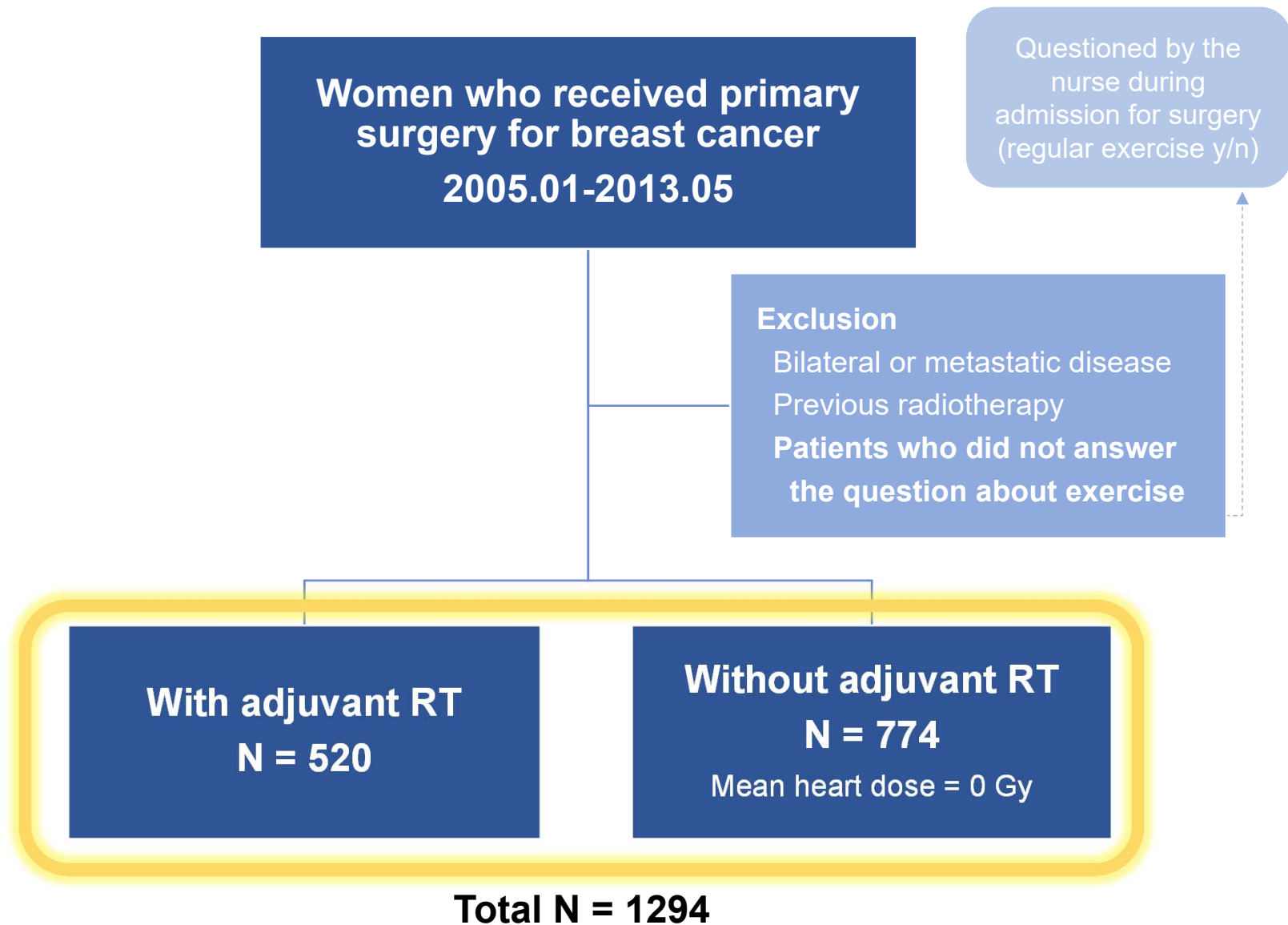
Risk of heart disease

Adjuvant RT
Exercise
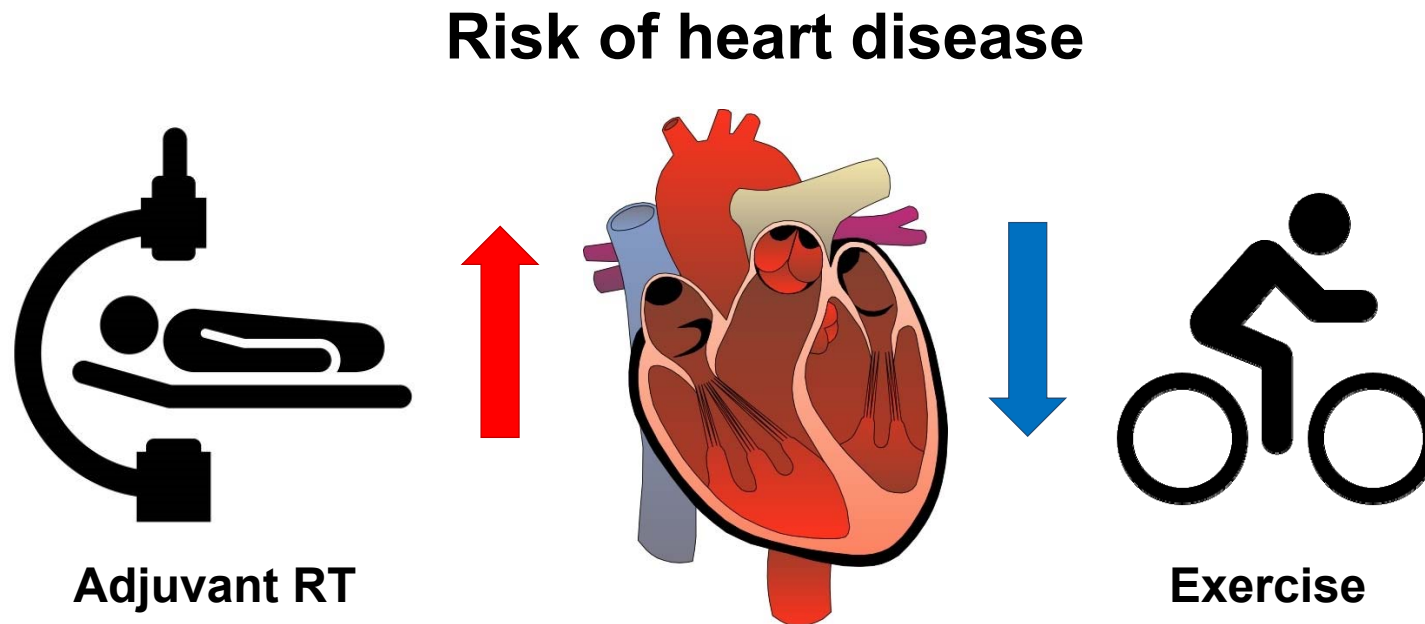
- The impact of **patient-specific factors** on the interaction between **cardiac risk and RT** has not been studied well.

- To analyze whether **adjuvant RT** increases the risk of cardiac toxicity in Asian breast cancer women,

- To analyze whether **patient-specific factors** would actually affect the risk of RT-related cardiac toxicity.

Women who received primary surgery for breast cancer
2005.01-2013.05

Questioned by the nurse during admission for surgery (regular exercise y/n)

Exclusion
Bilateral or metastatic disease
Previous radiotherapy
Patients who did not answer
the question about exercise

With adjuvant RT
N = 520

Without adjuvant RT
N = 774
Mean heart dose = 0 Gy

Total N = 1294

- **Primary endpoint:** **Major coronary event (MCE)**

  - ➤ Diagnosis of myocardial infarction

  - ➤ Diagnosis of coronary revascularization

  - ➤ Death resulting from ischemic heart disease

- **Mean heart dose (MHD)**

  - ➤ All patient's contours and dose distributions in every RT session were transferred and integrated to MIM software to display individual three-dimensional computed tomography planning data for each patient.
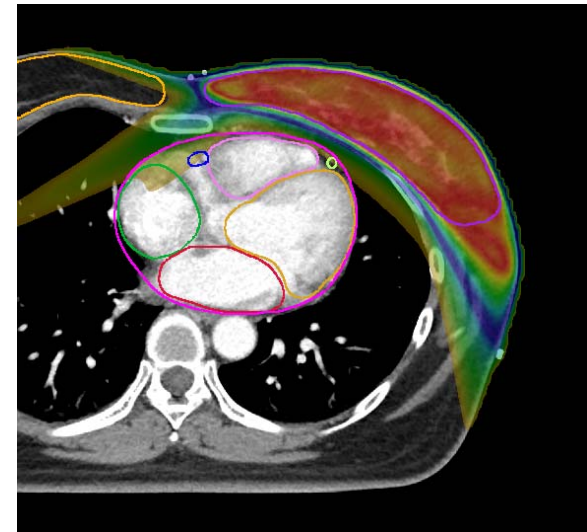
	n=1294	
	n	%
Age	50 (24-87)	
<55	833	64.4%
≥55	461	35.6%
BMI	22.83 (14.61-35.88)	
<30	1253	96.8%
≥30	41	3.2%
Laterality		
Left	718	55.5%
Right	576	44.5%
Exercise		
No	1106	85.5%
Yes	188	14.5%
Smoking		
No	1265	97.8%
Yes	29	2.2%
HTN		
No	994	76.8%
Yes	300	23.2%

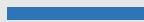|	n=1294	
	N	%
DM		
No	1210	93.5%
Yes	84	6.5%
History of heart disease		
No	1268	98.0%
Yes	26	2.0%
Type of surgery		
PM	416	32.1%
MRM	878	67.9%
Anthracycline chemotherapy		
No	591	45.7%
Yes	703	54.3%
Anti-HER2 treatment		
No	1155	89.3%
Yes	139	10.7%
Aromatase inhibitor		
No	844	65.2%
Yes	450	34.8%
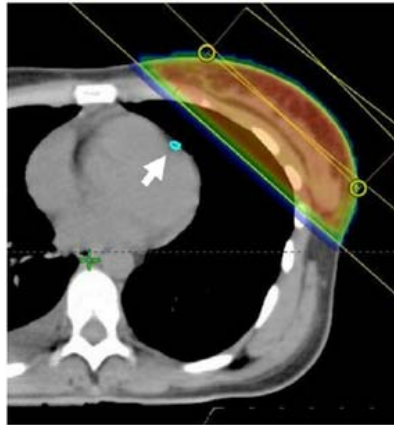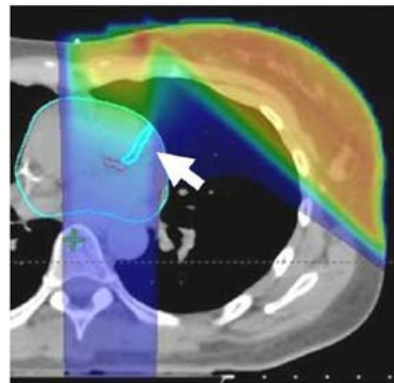
Lt. Breast w/o IMN RT

Lt. Breast with IMN RT

Venarini, S., et al. International Journal of Radiation Oncology• Biology• Physics 84.3 (2012): S226.
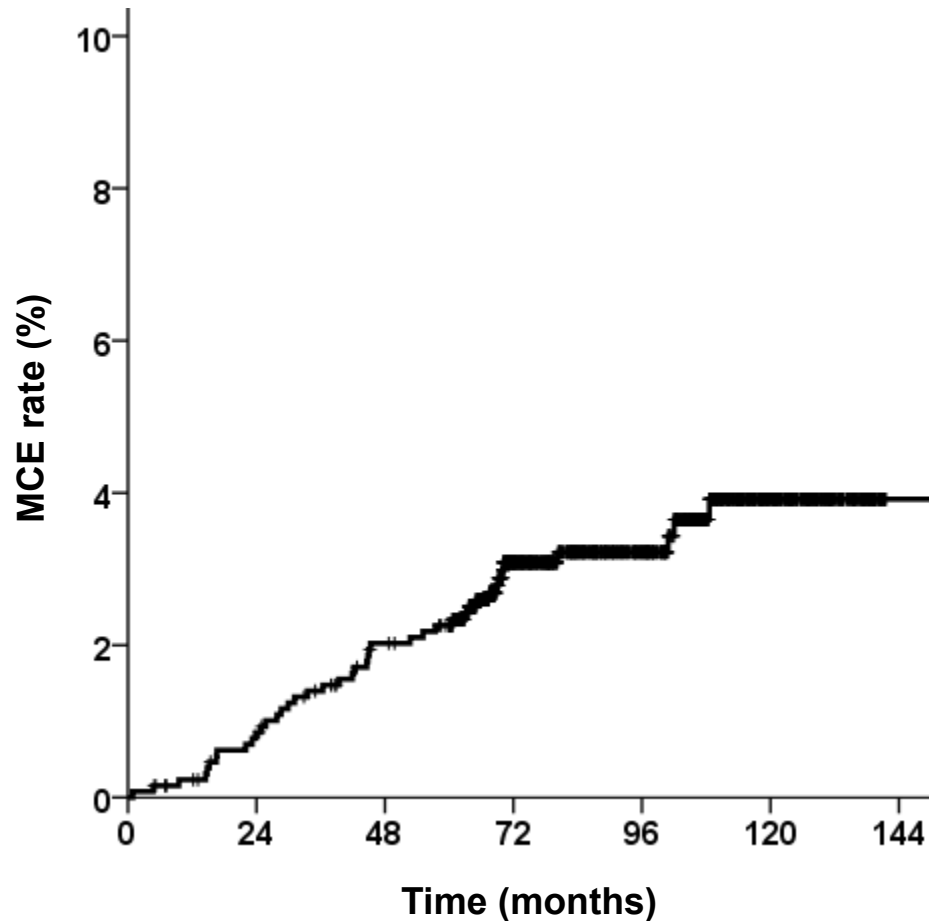
**IMN: internal mammary node
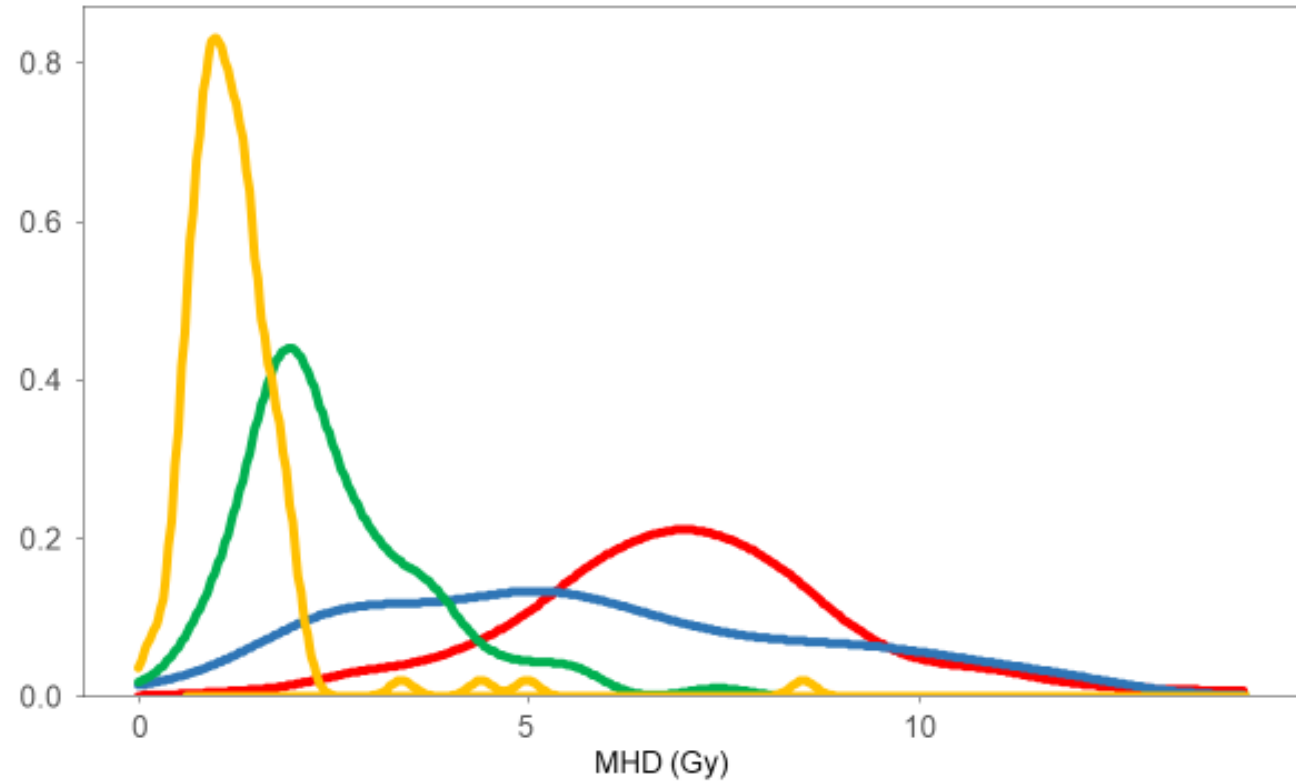
	Laterality	IMN RT	Median MHD
▬ (yellow)	Rt.	-	1.10 Gy
▬ (green)	Rt.	+	2.13 Gy
▬ (blue)	Lt.	-	5.22 Gy
▬ (red)	Lt.	+	6.79 Gy

- **Median follow-up period**

  ➢ 78.6 months (range, 60.0-153.7 months)

- **5-year MCE rate: 2.3%**

- **10-year MCE rate: 3.9%**

Variable	UVA			MVA		
	HR	95% CI	p-value	HR	95% CI	p-value
Age	1.05	1.02–1.08	<0.001	1.03	0.99–1.07	0.111
Exercise (yes vs. no)	**0.31**	**0.08–1.29**	**0.107**	**0.20**	**0.05–0.86**	**0.030**
Smoking (yes vs. no)	1.12	0.15–8.16	0.910	1.40	0.19–10.47	0.745
BMI	1.03	0.94–1.13	0.489	0.91	0.83–1.01	0.074
HTN (yes vs. no)	**3.16**	**1.73–5.79**	**<0.001**	**2.07**	**1.01–4.25**	**0.047**
DM (yes vs. no)	**5.33**	**2.61–10.87**	**<0.001**	**3.43**	**1.53–7.70**	**0.003**
Heart disease (yes vs. no)	1.24	0.17–9.04	0.745	0.40	0.05–3.05	0.376
Anthra CTx (yes vs. no)	0.59	0.32–1.09	0.089	0.69	0.34–1.39	0.298
Anti-HER2 Tx (yes vs. no)	0.70	0.22–2.27	0.550	0.72	0.21–2.49	0.606
Aromatase inhibitor (yes vs. no)	1.94	1.06–3.56	0.031	1.23	0.62–2.42	0.557
MHD (Gy)	**1.18**	**1.09–1.28**	**<0.001**	**1.21**	**1.12–1.31**	**<0.001**
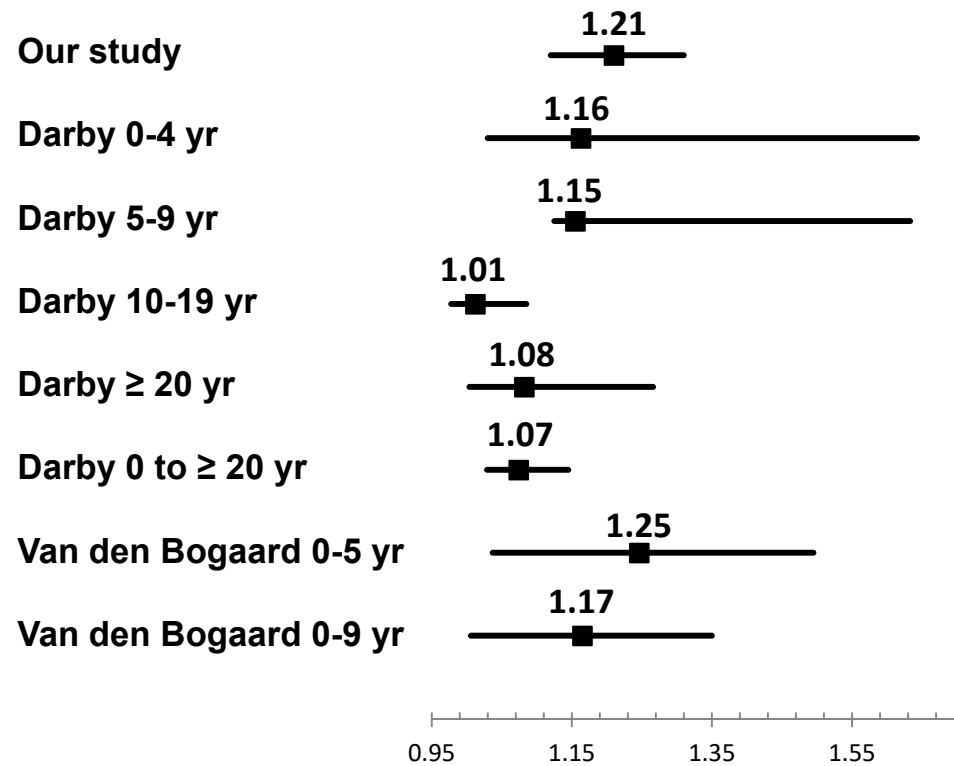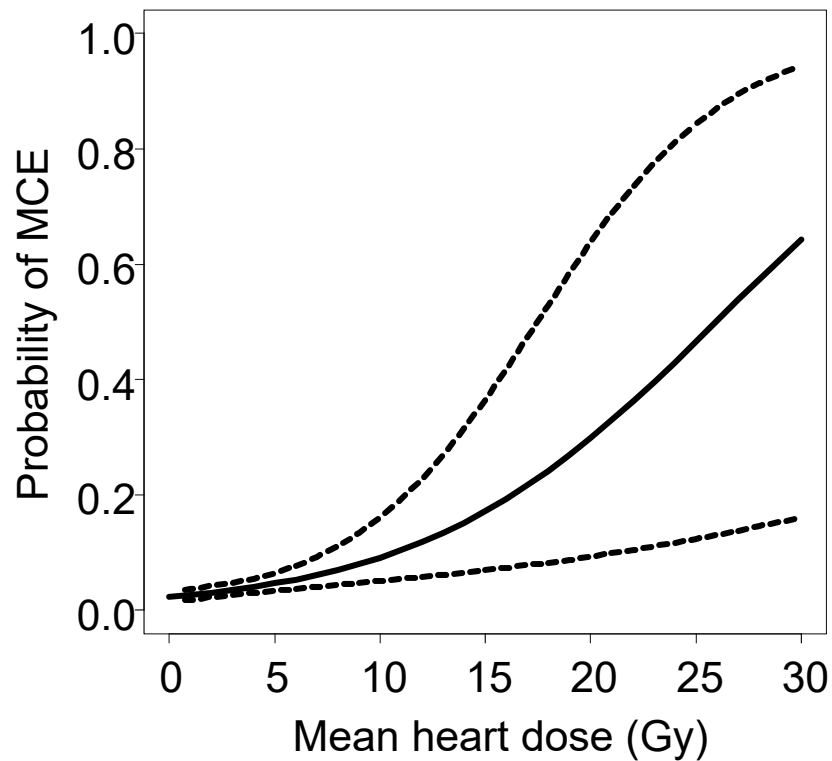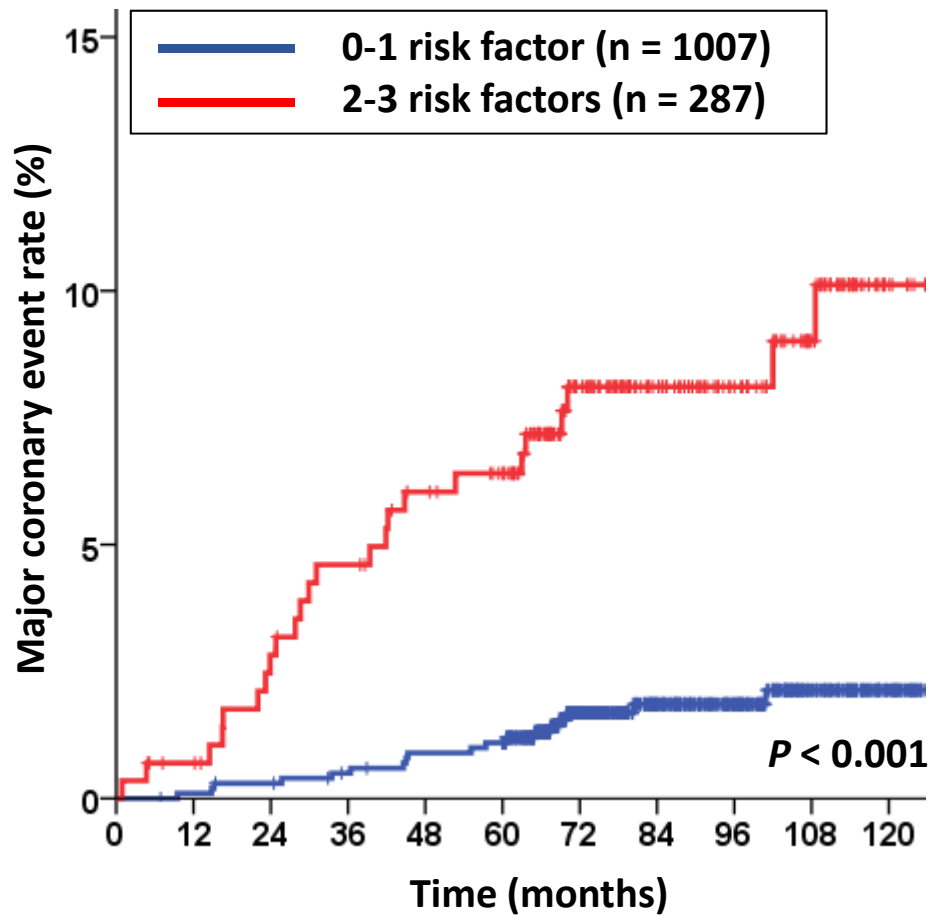
- **Risk factors**
  - ✓ HTN
  - ✓ DM
  - ✓ No exercise

- The impact size of increasing MHD (per Gy) was **similar** in women without or minimal risk factor, as compared to women with multiple risk factors.
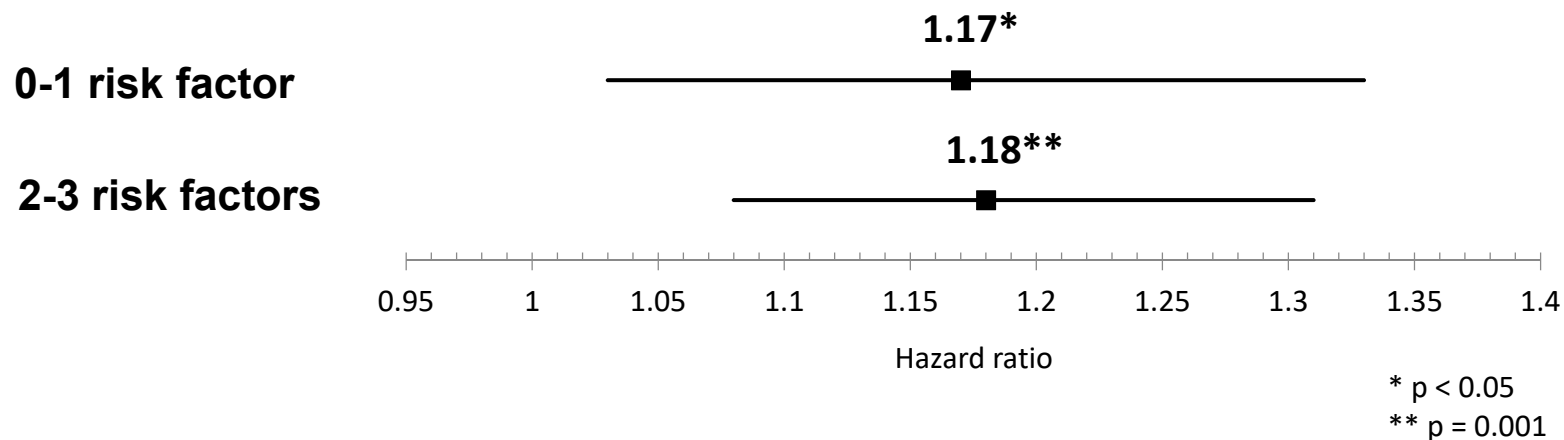
0-1 risk factor   1.17*

2-3 risk factors   1.18**

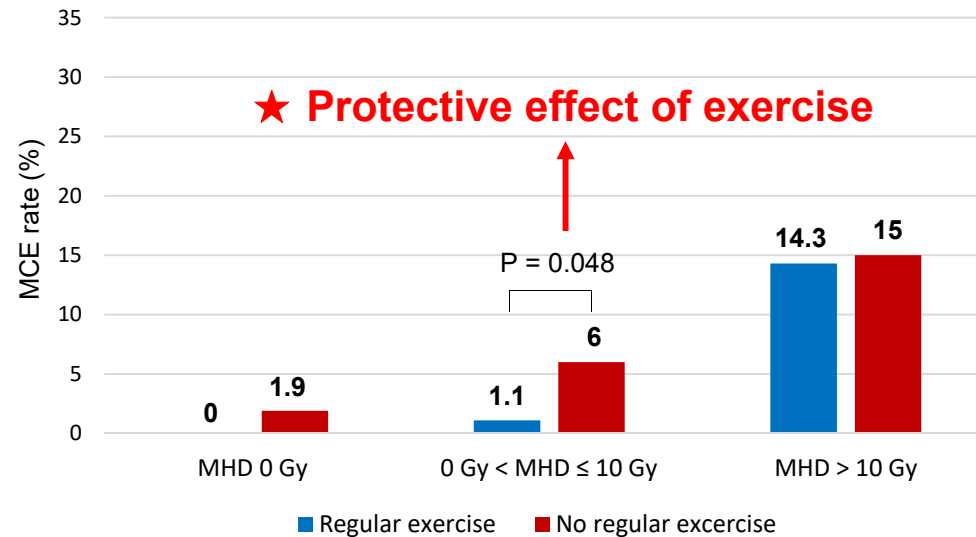0.95   1   1.05   1.1   1.15   1.2   1.25   1.3   1.35   1.4

Hazard ratio

* p < 0.05
** p = 0.001

HTN

MCE rate (%)

P = 0.001

	MHD 0 Gy	0 Gy < MHD ≤ 10 Gy	MHD > 10 Gy
HTN: No	1.4	2.4	5.9
HTN: Yes	2.7	11.4	30

■ HTN: No   ■ HTN: Yes

DM

MCE rate (%)

P = 0.004   P = 0.003

	MHD 0 Gy	0 Gy < MHD ≤ 10 Gy	MHD > 10 Gy
DM: No	1.4	4.2	12.5
DM: Yes	7.3	15	33.3

■ DM: No   ■ DM: Yes

Exercise

MCE rate (%)

★ **Protective effect of exercise**

P = 0.048

	MHD 0 Gy	0 Gy < MHD ≤ 10 Gy	MHD > 10 Gy
Regular exercise	0	1.1	14.3
No regular exercise	1.9	6	15
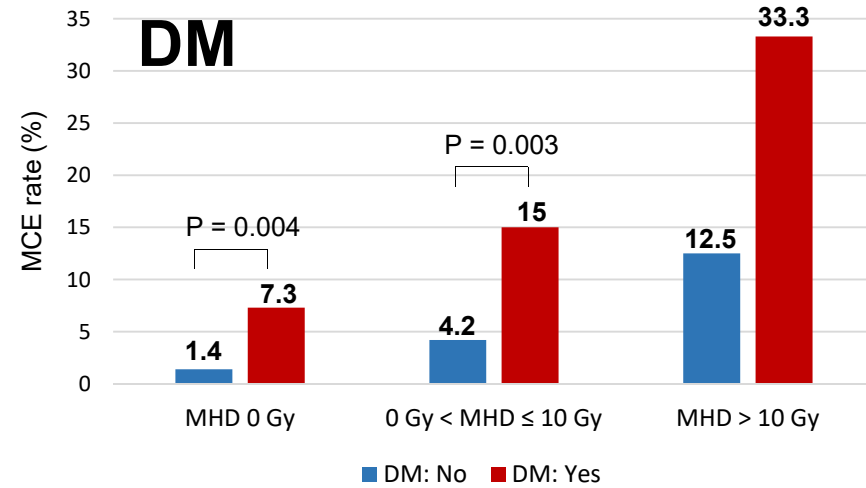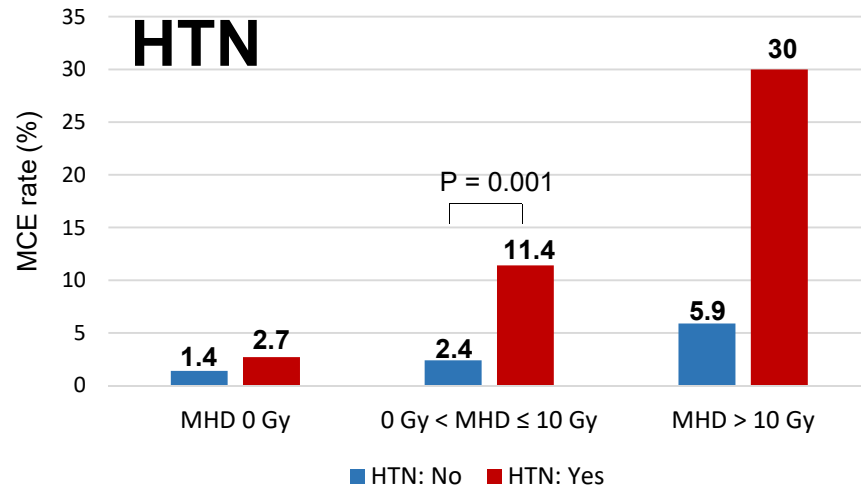
■ Regular exercise   ■ No regular excercise

- The relative risk of MCE significantly increased by **21%** as **MHD increased per 1 Gy.**

- The absolute risk of MCE significantly increased in **patients with more risk factors** such as HTN, DM and no regular exercise.

- However, the **impact size of increasing MHD was similar** in high risk and low risk groups.

- Especially in those who received 0 Gy < MHD ≤ 10 Gy, **regular exercise showed to have a protective effect**.

- This is the first study to report a **radiation dose-effect relationship for cardiac disease** in Korean breast cancer population.

- This result could increase physicians' awareness to adopt technical approaches to **minimize heart dose** in breast cancer patients undergoing adjuvant RT, **even in those without any risk factor for heart disease.**

Thank you for your attention.