

Supplementary Table 1. 5-year change in BI-RADS score for women with HS and without HS according to the menopause status among women with BI-RADS score 3 or 4

	Premenopause		Postmenopause	
	No HS	HS	No HS	HS
Mean BI-RADS score (95% CI) <sup>a</sup>				
Baseline	3.864 (3.822~3.907)	3.848 (3.801~3.894)	3.701 (4.572~3.830)	3.700 (3.564~3.836)
Year 5	3.842 (3.800~3.885)	3.740 (3.694~3.786)	3.557 (3.428~3.686)	3.528 (4.393~3.664)
5-year difference (year 5 – baseline)	-0.022 (-0.025~-0.019)	-0.107 (-0.116~-0.099)	-0.144 (-0.157~-0.130)	-0.172 (-0.194~-0.149)
Difference in mean BI-RADS score (95% CI) <sup>a</sup>				
Baseline	0 (reference)	-0.017 (-0.029~-0.004)	0 (reference)	-0.001 (-0.029~0.027)
Year 5	0 (reference)	-0.102 (-0.114~-0.091)	0 (reference)	-0.029 (-0.054~-0.003)
Difference in differences (year 5 – baseline)	0 (reference)	-0.086 (-0.094~-0.077)	0 (reference)	-0.028 (-0.053~-0.003)

<sup>a</sup> Estimated from linear mixed models with random intercept and random slopes used with BI-RADS 1–4 as the continuous outcome. Multivariable model was adjusted for HS, smoking, alcohol consumption, physical activity, BMI, total energy intake, hypertension, diabetes, sleep duration, sleep quality, female hormone medication, and parity as time-dependent variables and baseline age, center, year of screening exam, education level, and age at menarche as time-fixed variables.

Abbreviations: HS, hepatic steatosis; BMI, body mass index; CI, confidence interval

Supplementary Table 2. Hazard ratios (95% CI) of dense breast resolution by HS and its severity based on the FIB-4 index

	PY	Resolved cases	Resolution rate (/10 <sup>3</sup> PY)	Age-adjusted HR (95% CI)	Multivariable-adjusted HR (95% CI) <sup>a</sup>		HR (95% CI) <sup>b</sup> in a model using time-dependent variables
					Model 1	Model 2	
Pre-menopause							
No HS	278,002.7	2,291	8.2	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
HS	30,038.3	770	25.6	2.72 (2.51–2.96)	2.61 (2.40–2.84)	1.29 (1.17–1.42)	1.31 (1.20–1.44)
HS plus FIB-4 ≥1.3	694.5	25	36.0	2.90 (1.95–4.31)	2.76 (1.86–4.10)	1.52 (1.02–2.27)	1.37 (0.98–1.93)
Post-menopause							
No HS	17,592.1	632	35.9	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
HS	4,657.6	208	44.7	1.24 (1.06–1.45)	1.19 (1.02–1.40)	0.75 (0.64–0.89)	0.77 (0.66–0.91)
HS plus FIB-4 ≥1.3	1,258.4	96	76.3	1.40 (1.13–1.74)	1.43 (1.15–1.78)	0.96 (0.77–1.20)	0.88 (0.71–1.09)

$P < 0.001$  for the overall interaction between the menopause status and hepatic steatosis and its severity for dense breast resolution (multivariable-adjusted model 2)

<sup>a</sup> Estimated from parametric proportional hazard models for dense breast resolution with hepatic steatosis and its severity. Multivariable model 1 was adjusted for age, center, year of screening exam, alcohol consumption, smoking, physical activity, total energy intake, education level, hypertension, diabetes, sleep duration, sleep quality, age at menarche, female hormone medication, and parity; model 2: model 1 plus adjustment for BMI

<sup>b</sup> Estimated from parametric proportional hazard models for dense breast resolution with hepatic steatosis and its severity, smoking, alcohol consumption, physical activity, BMI, total energy intake, hypertension, diabetes, sleep duration, sleep quality, female hormone medication, and parity as time-dependent categorical variables and baseline age, center, year of screening exam, education level, and age at menarche as time-fixed variables

Abbreviations: HS, hepatic steatosis; Fibrosis-4, FIB-4; BMI, body mass index; CI, confidence interval; HR, hazard ratio; PY, person-years

Supplementary Table 3. Hazard ratios (95% CI) of dense breast resolution with explanatory factors.

	Multivariate-adjusted HR (95% CI) <sup>a</sup>	
	Model 1	Model 2
Age per one-year increment	1.07 (1.06-1.07)	1.06 (1.05-1.07)
Hepatic steatosis	2.62 (2.41-2.84)	1.30 (1.18-1.43)
Menopause	1.59 (1.40-1.81)	1.59 (1.40-1.81)
Hepatic steatosis	0.48 (0.41-0.56)	0.62 (0.53-0.73)
Alcohol consumption		
<10 g/day	1.00 (reference)	1.00 (reference)
10-20 g/day	1.09 (0.97-1.23)	1.03 (0.92-1.17)
≥20 g/day	1.20 (1.04-1.39)	1.12 (0.97-1.30)
Smoking		
Never	1.00 (reference)	1.00 (reference)
Ever	1.09 (0.96-1.23)	1.07 (0.94-1.20)
Current	1.21 (0.98-1.50)	1.25 (1.01-1.55)
Physical activity		
Inactive	1.00 (reference)	1.00 (reference)
Minimal	0.99 (0.92-1.07)	0.99 (0.92-1.07)
HEPA	1.10 (1.01-1.20)	1.07 (0.98-1.17)
Total energy intake		
Q1	1.00 (reference)	1.00 (reference)
Q2	1.00 (0.83-1.21)	1.00 (0.83-1.21)
Q3	1.05 (0.88-1.25)	1.01 (0.85-1.20)
Q4	1.03 (0.87-1.22)	0.98 (0.83-1.16)
Q5	1.09 (0.92-1.29)	1.00 (0.85-1.19)
Education level	0.93 (0.86-1.01)	1.05 (0.97-1.14)
History of hypertension	1.25 (1.12-1.40)	1.06 (0.95-1.19)
History of diabetes	1.08 (0.89-1.31)	1.05 (0.86-1.27)
Sleep duration		
≤5 hours	1.12 (1.00-1.25)	1.02 (0.92-1.14)
6 hours	1.09 (1.00-1.18)	1.05 (0.97-1.14)

7 hours	1.00 (reference)	1.00 (reference)
8 hours	0.98 (0.89-1.09)	0.99 (0.89-1.09)
≥9 hours	0.92 (0.77-1.11)	0.95 (0.79-1.14)
Poor sleep quality	1.05 (0.96-1.14)	1.08 (0.99-1.18)
Age at menarche		
10-11 years	1.41 (1.09-1.82)	1.20 (0.93-1.55)
12-13 years	1.12 (0.92-1.37)	1.05 (0.86-1.29)
14-15 years	0.94 (0.77-1.14)	0.94 (0.78-1.15)
16-17 years	0.94 (0.76-1.15)	0.97 (0.79-1.19)
≥18	1.00 (reference)	1.00 (reference)
Female hormone medication	1.04 (0.87-1.25)	1.10 (0.92-1.32)
Parity		
0	1.00 (reference)	1.00 (reference)
1	1.28 (1.06-1.54)	1.40 (1.16-1.68)
2	1.51 (1.27-1.79)	1.63 (1.37-1.94)
≥3	1.92 (1.59-2.30)	1.99 (1.66-2.40)
BMI per one kg/m <sup>2</sup> increment		1.19 (1.18-1.20)

<sup>a</sup> Estimates from parametric proportional hazard models for dense breast resolution with hepatic steatosis. Multivariate model 1 was adjusted for age, center, year of screening examination, alcohol consumption, smoking, physical activity, total energy intake, education level, hypertension, diabetes, sleep duration, sleep quality, age at menarche, female hormone medication, and parity; model 2: model 1 along with adjustment for BMI

Abbreviations: HS, hepatic steatosis; BMI, body mass index; CI, confidence interval; HR, hazard ratio; HEPA, health-enhancing physical activity