Association between obesity and heart failure and related atrial fibrillation:
patient-level data comparisons of two cohort studies

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COI Disclosure

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Backgrounds

Heart failure (HF) and Atrial fibrillation (AF)

- Contribute to morbidity, mortality, and hospital admission.
- Over 50% of HF patients have AF, while one-third of those with AF develop HF.
- Incidence of HF and AF varies among different ethnic populations.

Obesity

- Known risk factor for both HF and AF, may explain these ethnic disparities.
- 1-unit increase in body mass index increasing the incidence of HF by 5% in men and 7% in women.
- 5-unit increase in BMI conferring a 29% greater risk of incident AF.
- A J-curve relationship between BMI and the risk of AF was observed in the Asian population.

Backgrounds

Objectives

- Variations in BMI distribution among populations may contribute to the ethnic disparities in the incidence of HF and HF-related AF.

- Compared patient-level data from two cohorts, the Korea National Health Insurance Service-Health Screening (K-NHIS-HealS) and the UK Biobank.

- Aim of examining whether obesity mediates the association between HF and HF-related AF in European and Asian populations.

Methods

K-NHIS-HealS

- Based on information obtained through national health screening programs.
- All insured adults are eligible for a general health check-up program conducted biennially.
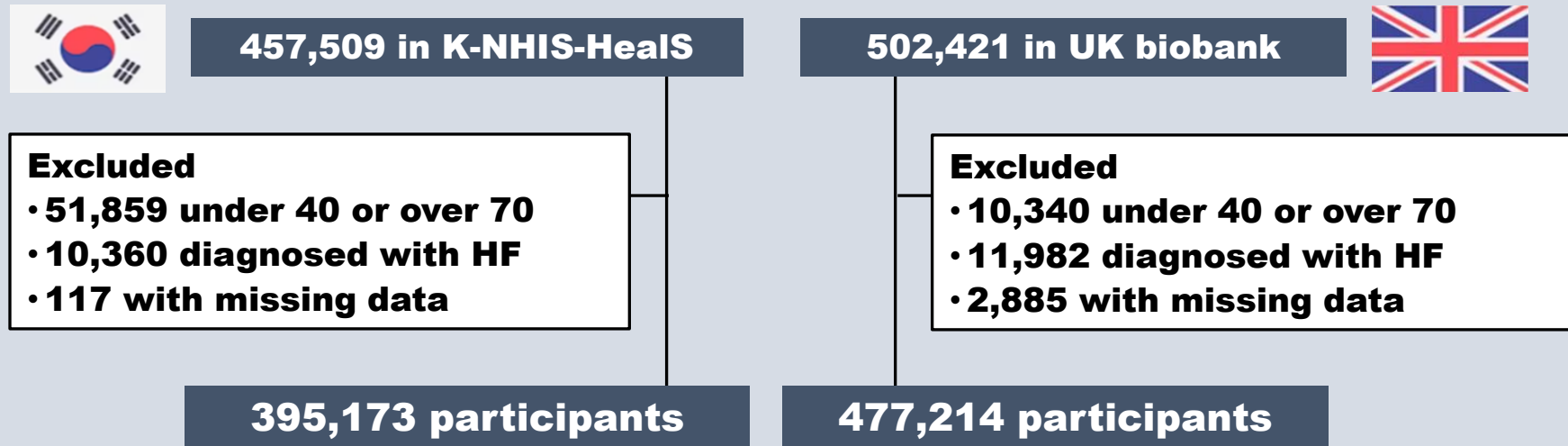- Included 457,509 Koreans aged 40–79 years between 2005 and 2010.

UK Biobank

- Involves 502,421 participants aged 40–69 years between 2006 and 2010.
- Investigate the genetic and lifestyle determinants of middle and later life.
- Extensive questionnaire data, physical measurements, and biological samples.

Methods

- A total of 395,173 participants from K-NHIS-HealS and 477,214 from UK Biobank.

Figure. Study Population

457,509 in K-NHIS-HealS	502,421 in UK biobank

Excluded
- 51,859 under 40 or over 70
- 10,360 diagnosed with HF
- 117 with missing data

Excluded
- 10,340 under 40 or over 70
- 11,982 diagnosed with HF
- 2,885 with missing data

395,173 participants	477,214 participants

Methods

Heart failure
- The first occurrence during more than two different days of hospital visits.
- The first admission with a diagnosis of HF perusing the ICD-10 code (I11.0, I50, I97.1).
- Self-reported non-cancer illness codes (1076) were taken into account for the UK cohort.

Atrial fibrillation
- The first occurrence during more than two different days of hospital visits
- The first admission with a diagnosis of AF per using the ICD-10 code (I48).
- Self-reported non-cancer illness codes (1471, 1483) were considered for the UK cohort.

Results

K-NHIS-HealS

- Among 395,173 participants with a mean age of 53.8 years and 55.2% male.
- 7,212 (1.8%) were classified as underweight, 251,022 (63.5%) had normal weight, 126,420 (32.0%) were overweight, and 10,519 (2.7%) were obese.

UK Biobank

- Among 477,214 participants with a mean age of 56.7 years and 45.4% male.
- 2,519 (0.5%) were underweight, 156,570 (32.8%) had normal weight, 202,542 (42.4%) were overweight, and 115,583 (24.2%) were obese.
- The proportions of obese ($P < 0.001$) and severely obese ($P < 0.001$) individuals were significantly higher in the UK cohort.

Results

Heart failure

- In the K-NHIS-HealS cohort 684 (0.17%) participants developed HF, and 3,183 (0.67%) participants developed HF in the UK Biobank.

Heart failure-related atrial fibrillation

- In the K-NHIS-HealS cohort 236 (0.06%) participants developed HF-related AF, and 1,660 (0.35%) participants developed HF in the UK Biobank.

Results

	K-NHIS-HealS				UK Biobank			
	Underweight (n=7212)	Normal (n=251022)	Overweight (n=126420)	Obese (n=10519)	Under-weight (n=2519)	Normal (n=156570)	Overweight (n=202542)	Obese (n=115583)
HF incidence (/1,000 PYRs)[*]	0.46	0.21	0.26	0.50	0.72	0.33	0.44	1.16
HF-related AF incidence (/1,000 PYRs)[*]	0.16	0.06	0.08	0.17	0.46	0.18	0.21	0.59

[*]Sex- and age-adjusted incidence of HF or HF-related AF

- The overall incidence of HF and HF-related AF was significantly higher in the UK Biobank cohort than in the K-NHIS-Heals cohort.

Results

Heart failure

- Obesity was associated with HF occurrence in both populations.
- 5-unit increase in BMI was found to correlate with a 48% greater risk of HF in the UK Biobank cohort (P < 0.001), but not in the K-NHIS-HealS cohort (P = 0.288).

	K-NHIS-HealS		UK Biobank		P for interaction
	sHR (95% CI)	P Value	sHR (95% CI)	P Value	
BMI as a categorical variable[*]					< 0.001
Underweight	2.40 (1.61–3.57)	< 0.001	1.96 (1.13—3.40)	0.017	
Normal	1 (reference)		1 (reference)		
Overweight	1.10 (0.94–1.30)	0.248	1.14 (1.02–1.27)	0.018	
Obese	1.81 (1.30–2.53)	< 0.001	2.20 (1.98–2.45)	< 0.001	
BMI as 5-unit increase[*]	1.07 (0.94–1.22)	0.288	1.48 (1.43–1.53)	< 0.001	< 0.001

[*]Adjusted for age, sex, and clinical variables

Results

Heart failure-related atrial fibrillation

- Obesity was associated with HF-related AF occurrence in both the Korean and UK populations.
- 5-unit increase in BMI correlated with a 52% (P < 0.001) greater risk of HF-related AF in the UK Biobank cohort, but not in the K-Korean NHIS-HealS cohort (P = 0.275).

	K-NHIS-HealS		UK Biobank		P for interaction
	sHR (95% CI)	P Value	sHR (95% CI)	P Value	
BMI as a categorical variable*					< 0.001
Underweight	2.55 (1.33–4.88)	0.005	2.14 (1.01–4.55)	0.047	
Normal	1 (reference)		1 (reference)		
Overweight	1.20 (0.91–1.58)	0.202	1.02 (0.88–1.18)	0.800	
Obese	2.21 (1.26–3.88)	0.006	2.15 (1.86–2.48)	< 0.001	
BMI as 5-unit increase*	1.13 (0.91–1.41)	0.275	1.52 (1.45–1.59)	< 0.001	< 0.001

*Adjusted for age, sex, and clinical variables

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Results

Figure. Cubic spline graph for adjusted hazard ratio for (A) heart failure, (B) HF-related atrial fibrillation according to BMI
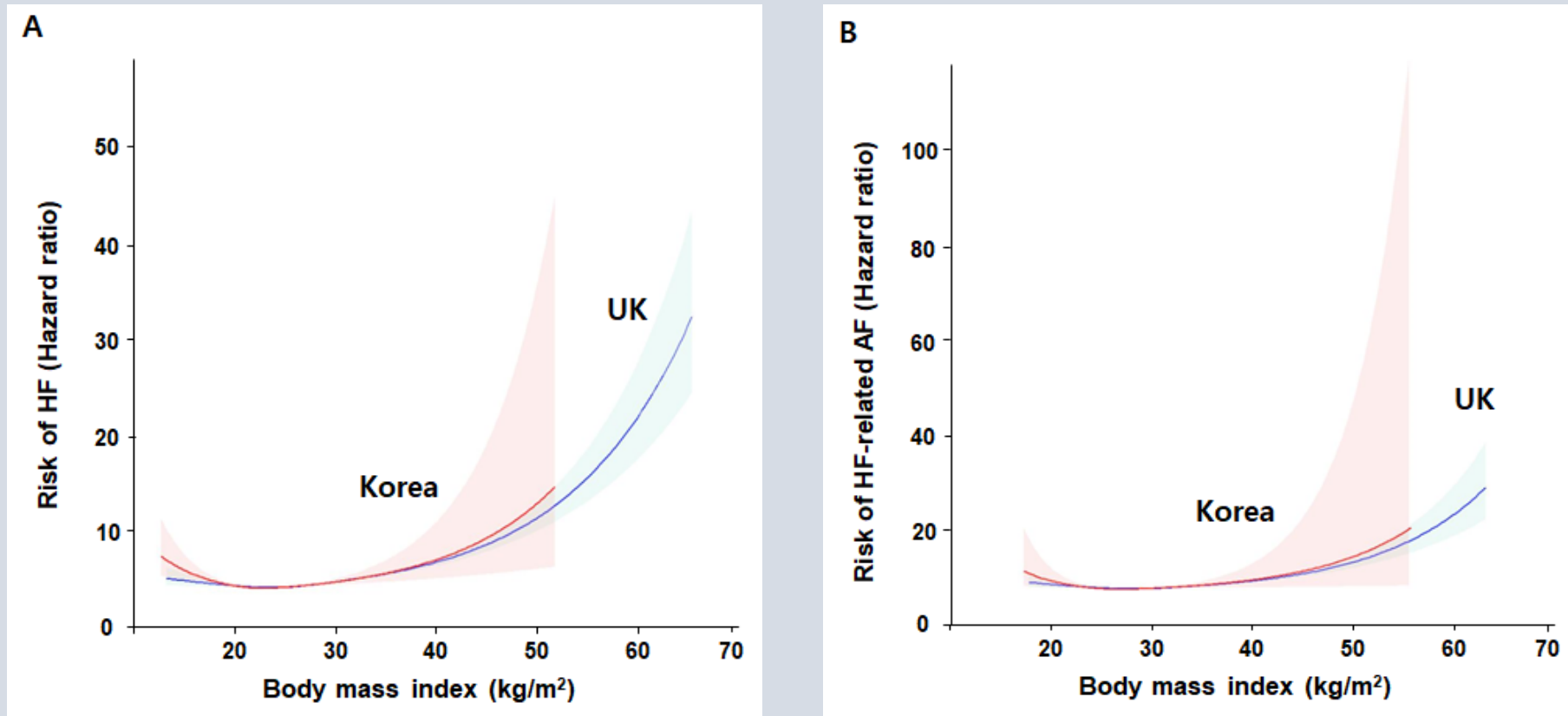
Conclusions

- Obesity was associated with an increased risk of HF and HF-related AF in both Korean and UK populations.

- The higher incidence of HF and HF-related AF in the UK population was likely because of the higher proportion of obese individuals in that cohort, particularly those in the obese BMI category.