Contemporary Assessment of Left Ventricular Diastolic Function in Older Adults: The Atherosclerosis Risk In Communities Study

SUPPLEMENTAL MATERIAL

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Supplemental Tables and Figures

Supplemental Figure 1. Scatter plots and restricted cubic splines demonstrating the continuous relationship between LV diastolic measures (TDI e', E/e' ratio, LA A-P dimension, and LAVi) and Log(NT-proBNP) levels assessed concomitantly at Visit 5 among ARIC participants without prevalent heart failure at Visit 5. Y-axis shows geometric mean values of NT-proBNP.

Supplemental Table 1. Prevalence of abnormalities of LV diastolic function, and the association of measure of LV diastolic function with incident HF hospitalization or death, stratified by sex.

	Hazard Ratio for Continuous Relationship			**Dichotomous Categorization using ARIC Reference Limits**					
				Percent Abnormal			**Hazard Ratio**		
	Women	**Men**	**interact P**	**Women**	**Men**	**P**	**Women**	**Men**	**interact P**
TDI e'$_{septal}$ (cm/sec)	1.20 (1.01-1.43), p=0.036	1.06 (0.93-1.21), p=0.40$^{\tau}$	0.34	20%	21%	0.20	1.54 (0.95-2.52), p=0.08	1.74 (1.13-2.67), p=0.01	0.65
TDI e'$_{lateral}$ (cm/sec)	1.16 (1.02-1.32), p=0.02	0.95 (0.87-1.03), p=0.24	0.009	19%	17%	0.02	2.21 (1.39-3.50), p=0.001	1.19 (0.73-1.94), p=0.49	0.07
E/e'$_{septal}$	1.10 (1.06-1.13), p<0.001	1.10 (1.07-1.13), p<0.001	0.91	23%	27%	0.004	1.72 (1.09-2.73), p=0.02	2.46 (1.64-3.68), p<0.001	0.25
E/e'$_{lateral}$	1.10 (1.06-1.14), p<0.001	1.09 (1.05-1.14), p<0.001	0.74	20%	22%	0.19	2.02 (1.27-3.20), p=0.003	2.15 (1.42-3.27), p<0.001	0.92
LA width (cm)	1.55 (0.98-2.46), p=0.06	2.76 (2.10-3.64), p<0.001	0.09	27%	30%	0.03	1.83 (1.17-2.86), p=0.009	3.07 (2.04-4.62), p<0.001	0.17

LAVi (ml/m^2)	1.05 (1.02-1.07), p<0.001	1.03 (1.02-1.03), p<0.001[t]	0.21	21%	25%	0.004	1.53 (0.94-2.50), p=0.09	3.31 (2.20-4.97), p<0.001	0.02

Abnormal defined using ARIC-based reference limits. P value for between sex comparison of prevalence of abnormal measures is adjusted for age and race. Cox proportional hazards models adjust for age and race. Interact P – P for interaction. [τ]P for nonlinear trend = 0.01, P for overall trend=0.009; [t]P for nonlinear trend = 0.001, P for overall trend <0.0001

Supplemental Table 2. Prevalence of abnormalities of LV diastolic function, and the association of measure of LV diastolic function with incident HF hospitalization or death, stratified by race.

	Hazard Ratio for Continuous Relationship			**Dichotomous Categorization using ARIC Reference Limits**					
				Percent abnormal			**Hazard Ratio**		
	White	**Black**	**interact P**	**White**	**Black**	**P**	**White**	**Black**	**interact P**
TDI e'_{septal} (cm/sec)	1.07 (0.94-1.21), p=0.30	1.29 (1.02-1.64), p=0.03	0.29	19%	25%	<0.001	1.33 (0.90-1.97), p=0.15	2.88 (1.56-5.30), p=0.001	0.05
TDI $e'_{lateral}$ (cm/sec)	0.97 (0.90-1.05), p=0.44	1.22 (1.03-1.44), p=0.02[§]	0.03	18%	19%	0.12	1.23 (0.82-1.85), p=0.31	3.30 (1.79-6.11), p<0.001	0.01
E/e'_{septal}	1.09 (1.06-1.11), p<0.001*	1.14 (1.09-1.19), p<0.001	0.14	25%	26%	0.05	1.81 (1.27-2.57), p=0.001	3.28 (1.78-6.03), p<0.001	0.15
$E/e'_{lateral}$	1.07 (1.03-1.11), p<0.001	1.18 (1.12-1.25), p<0.001	0.02	21%	18%	0.11	1.57 (1.09-2.26), p=0.016	4.94 (2.68-9.09), p<0.001	0.003
LA width (cm)	2.16 (1.63-2.87), p<0.001	3.14 (1.69-5.84), p<0.001	0.12	30%	21%	<0.001	2.24 (1.59-3.14), p<0.001	3.08 (1.66-5.73), p<0.001	0.44

LAVi (ml/m^2)	1.03 (1.02-1.03), p<0.001[τ]	1.08 (1.04-1.12), p<0.001	0.01	23%	23%	0.39	2.29 (1.62-3.26), p<0.001	2.59 (1.39-4.82), p=0.003	0.99

Abnormal defined using ARIC-based reference limits. P value for between race comparison of prevalence of abnormal measures is adjusted for age and sex. Cox proportional hazards models adjust for age and sex. Interact P – P for interaction. *P for nonlinear trend = 0.02, P for overall trend=0.009; [τ]P for nonlinear trend = 0.01, P for overall trend <0.0001; [t]P for nonlinear trend = 0.04, P for overall trend =0.0001; [§]P for nonlinear trend = 0.01, P for overall trend =0.003

Supplemental Table 3. Reference values for cardiac structure and function in ARIC at Visit 5 compared with values from select healthy cohorts and American Society of Echocardiography guideline recommendations.

LV STRUCTURE													
	ARIC		**SHS/NYC sample*[1]**		**NORRE[2]**		**Guidelines†[3]**						
Publication year	**2015**		**2001**		**2014**		**2015**						
	Women	Men	Women	Men	Women	Men	Women	Men					
N	271	142	206	207	320	414	~300-700	~200-500					
Mean age	74.0 ± 4.4	75.5 ± 4.8	SHS: 58±8 NYC: 42±11	SHS: 59±8 NYC: 45±11	45.4±13.1	46.3±13.7	45±8 (parasternal views) 47±17 (apical views)‡						
LA width	3.20 ± 0.39	3.45 ± 0.45	3.00±0.36	3.28±0.47									
LV DIASTOLIC FUNCTION													
	ARIC	**FLEMENGO[4]**		**de Sutter et al[5]**		**HUNT[6]**		**LOLIPOP[7]**		**NORRE[8]**		**Guidelines[9]**	
Age category	**Overall**	**Overall**	**≥60**	**65-74**	**>74**	**Overall**	**>60**	**Overall**	**65-75**	**Overall**	**>60**	**>60**	
N	413	239	24	35	17	1266	269	453	30	449	83	-	
Age	74.4±4.5	43.7±12.9	-	-	-	~49.5±13.6		51	69±3	45.8±13.7		-	
Female	65%	48%	-	-	-	52%	44%	44%	33%	56%	53%	-	
White	93%	-	-	-	-			43%	53%	-	-	-	
E wave	65 ± 16	-	-	77±21	74±20	F:75±16 M: 66±15	F:69±16 M:61±14	-	64.7±14.8	0.76±0.17	0.70±0.16	-	
A wave	73 ± 16	-	-	76±21	83±22	F: 58±18 M: 54±17	F:75±18 M: 65±18	-	71.8±16.7	0.60±0.17	0.74±0.16	-	
E/A ratio	0.92 ± 0.26	1.39 [1.19-1.70]	0.89 [0.81-1.12]	1.08±0.43	0.98±0.58	F: 1.42±0.62 M: 1.34±0.54	F:0.96±0.32 M:0.99±0.34	-	0.9±0.2	1.37±0.51	0.98±0.29	0.96±0.18	
s'_{septal}	6.8 ± 1.2	-	-	-	-	8.0±1.2	-	8.1±1.5	7.6±1.2	8.1±1.4	7.5±1.3 (5.0-10.0)	-	
e'_{septal}	6.2 ± 1.5	-	-	7±2.1	6.2±1.7	9.9±2.9	-	8.6±1.9	7.5±1.4	10.3±3.0 (8.0-12.0)	7.6±2.3 (3.0-13.0)	10.4±2.1	

E/e'_{septal}	10.8 ± 3.1	-	-	11.5±3.1	12.4±3.3	7.5±2.4	9.0±3.1	8.7±2.2	8.9±2.3	7.9±2.4 (6.1-9.2)	9.7±2.8 (5.0-16.9)	-
$s'_{lateral}$	7.4 ± 1.6	-	-	-	-	8.8±1.8	-	10.2±2.4	9.9±2.3	9.8±2.4	8.5±2.5 (4.0-15.0)	-
$e'_{lateral}$	7.5 ± 1.9	-	-	-	-	12.5±3.7	-	12.2±3.0	10.5±1.9	13.5±4.0 (10.0-16.0)	9.6±2.8 (4.0-17.0)	12.9±3.5
$E/e'_{lateral}$	9.1 ± 2.9	-	-	-	-	6.8±2.3	8.4±2.9	6.3±1.9	6.3±1.8	6.1±2.1 (4.6-7.3)	7.8±2.2 (4.2-12.8)	-

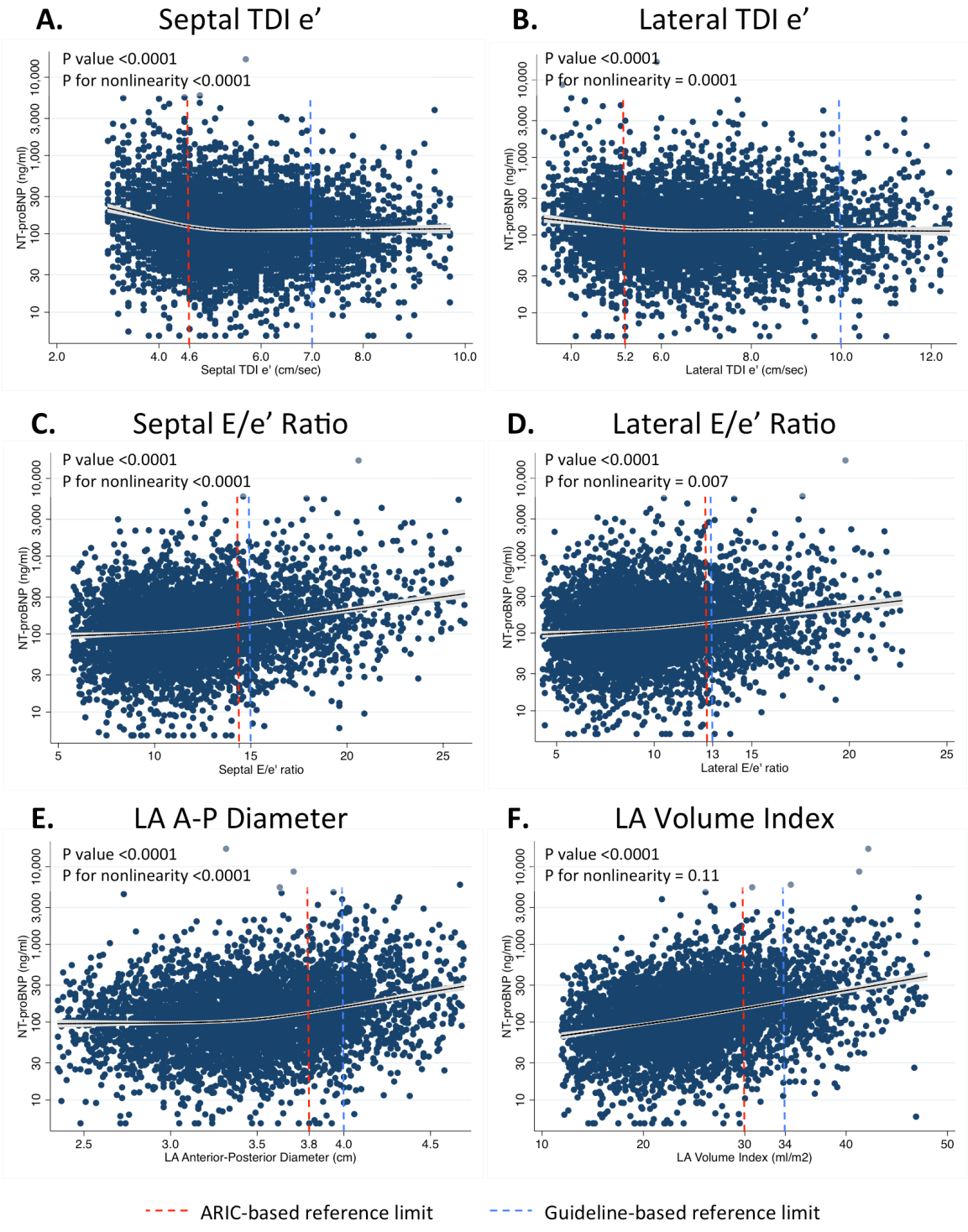
Values are mean ± standard deviation (SD) unless otherwise specified. *Values are for white participants; †Based on unpublished data from the Asklepios study, FLEMENGHO study, CARDIA study, and Padua study incorporated in the guideline document. ‡Measures from parasternal views: LVEDD, LVESD, IVS, PW, LV mass, RWT; measures from apical views: LVEDV, LVESV.

Supplemental Table 4. Percentile limits for the distribution of measures of LV diastolic function among the ARIC healthy sub-group restricted to participants with BMI of 18-25 kg/m^2 (n=206).

	5%-ile (95% CI)	10%-ile (95% CI)	20%-ile (95% CI)	50%-ile (95% CI)	80%-ile (95% CI)	90%-ile (95% CI)	95%-ile (95% CI)
TDI e'$_{septal}$ (cm/sec)							
Overall	4.1 (3.8 - 4.4)	4.5 (4.2 - 4.8)	5.0 (4.8 - 5.2)	6.2 (5.9 - 6.5)	7.7 (7.3 - 8.1)	8.5 (8.1 - 8.9)	9.1 (8.2 -10.0)
Female	4.1 (3.7 - 4.5)	4.5 (4.2 - 4.8)	5.0 (4.7 - 5.3)	6.2 (5.9 - 6.5)	7.9 (7.5 - 8.3)	8.7 (8.2 - 9.2)	9.3 (8.5 -10.1)
Male	4.1 (3.4 - 4.8)	4.8 (4.2 - 5.4)	5.2 (4.7 - 5.7)	6.0 (5.4 - 6.6)	7.3 (6.6 - 8.0)	7.9 (7.1 - 8.7)	8.1 (6.7 - 9.5)
TDI e'$_{lateral}$ (cm/sec)							
Overall	5.0 (4.6 - 5.4)	5.3 (5.1 - 5.5)	5.8 (5.5 - 6.1)	7.4 (7.1 - 7.8)	9.1 (8.7 - 9.6)	10.2 (9.5 -10.9)	11.1 (10.3 -11.9)
Female	4.9 (4.4 - 5.4)	5.2 (5.0 - 5.5)	5.8 (5.4 - 6.2)	7.4 (7.0 - 7.8)	9.2 (8.6 - 9.8)	10.5 (9.7 -11.3)	11.2 (10.3 -12.1)
Male	5.3 (4.4 - 6.2)	5.4 (5.0 - 5.8)	6.1 (5.5 - 6.7)	7.7 (7.0 - 8.4)	8.9 (7.9 – 10.0)	9.8 (8.4 -11.2)	10.4 (8.8 -12.0)
E/e'$_{septal}$							
Overall	6.7 (6.0 - 7.5)	7.1 (6.8 - 7.5)	8.1 (7.7 - 8.6)	10.2 (9.6 -10.8)	13.1 (12.5 -13.8)	14.4 (13.4 -15.4)	16.2 (13.4 -19.0)
Female	6.7 (5.9 - 7.5)	7.1 (6.7 - 7.5)	8.1 (7.6 - 8.6)	10.6 (10.0 -11.3)	13.5 (12.7 -14.3)	15.0 (14.0 -16.0)	16.5 (14.1 -19.0)
Male	6.9 (5.5 - 8.3)	7.1 (6.5 - 7.7)	7.6 (6.7 - 8.5)	9.3 (8.2 -10.4)	11.6 (10.2 -13.0)	12.6 (10.9 -14.3)	13.2 (9.0 -17.4)
E/e'$_{lateral}$							
Overall	5.4 (4.8 – 6.0)	6.1 (5.7 - 6.5)	6.7 (6.4 - 7.0)	8.6 (8.1 - 9.1)	10.9 (10.3 -11.5)	12.5 (11.5 -13.5)	13.9 (12.3 -15.5)

Female	5.6 (4.9 - 6.3)	6.2 (5.7 - 6.7)	7.0 (6.6 - 7.4)	9.0 (8.5 - 9.5)	11.4 (10.6 -12.2)	13.2 (12.0 -14.4)	14.9 (13.5 -16.3)
Male	5.0 (3.8 - 6.3)	5.5 (4.6 - 6.4)	6.1 (5.3 - 6.9)	7.3 (6.4 - 8.2)	9.6 (8.2 -11.0)	10.6 (8.5 -12.7)	11.9 (9.5 -14.3)
LA A-P dimension (cm)							
Overall	2.5 (2.3 - 2.7)	2.7 (2.6 - 2.8)	2.9 (2.8 - 2.9)	3.1 (3.1 - 3.2)	3.5 (3.4 - 3.5)	3.6 (3.5 - 3.7)	3.8 (3.7 – 4.0)
Female	2.4 (2.2 - 2.7)	2.7 (2.5 - 2.8)	2.8 (2.7 - 2.9)	3.1 (3.0 - 3.1)	3.4 (3.3 - 3.5)	3.5 (3.4 - 3.6)	3.6 (3.4 - 3.8)
Male	2.6 (2.2 - 3.1)	2.9 (2.7 - 3.1)	3.0 (2.9 - 3.2)	3.3 (3.2 - 3.4)	3.7 (3.6 - 3.9)	3.8 (3.7 – 4.0)	3.9 (3.6 - 4.3)
LAVi (ml/m^2)							
Overall	13.1 (11.7 -14.6)	14.5 (13.2 -15.8)	17.6 (16.4 -18.8)	21.6 (20.6 -22.7)	26.7 (25.3 -28.0)	29.8 (28.3 -31.3)	31.5 (26.8 -36.3)
Female	12.8 (11.2 -14.5)	14.3 (12.7 -15.9)	17.2 (15.9 -18.5)	21.3 (20.2 -22.4)	26.2 (24.5 -27.8)	29.8 (27.8 -31.7)	31.4 (26.5 -36.3)
Male	13.1 (10.3 -15.9)	16.0 (13.2 -18.8)	18.7 (16.5 -21.0)	23.3 (21.4 -25.2)	28.4 (25.6 -31.2)	30.2 (26.9 -33.6)	32.0 (23.6 -40.5)

Supplemental Figure 1.



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