Supplemental Table 1. Association between long-term and recent weight change and HR-pQCT indices at the tibia and radius, adjusted for age, sex, height, current smoking, diabetes **and initial weight** (i.e. initial weight = weight at enrollment for long-term weight change; and initial weight = weight at preceeding clinic visit for recent weight change). Beta coefficients are presented for weight change treated as a continuous variable, and least square means are presented for weight change group.

HR--pQCT indices[c]	Weight Change[a]											
	Long-term weight change						Recent weight change					
	Continuous		*Catogorical Measure*				*Continuous*		*Catogorical Measure*			
	Beta	P-value[b]	≥5% loss (N=166)	<5% change (N=275)	≥5% gain (N=920)	P-value[b]	Beta	P-value[b]	≥5% loss (N=301)	<5% change (N=834)	≥5% gain (N=226)	P-value[b]
Tibia (N=1328)[d]			Mean[e]						Mean[e]			
Ct.BMD	0.7246	**<.0001**	832.2	838.6	858.2	**<.0001**	1.2199	**<.0001**	836.8	852.8	858.5	**0.0005**
Ct.Po	-0.0115	**0.0356**	10.312	10.629	10.086	0.4490	-0.0365	**0.0046**	10.666	10.251	9.936	**0.0143**
Ct.Th	0.0033	**<.0001**	1.100	1.158	1.228	**<.0001**	0.0042	**<.0001**	1.159	1.201	1.232	**0.0009**
Tb.BMD	0.2920	**<.0001**	162.0	171.1	174.9	**<.0001**	0.2151	0.1297	170.4	173.6	175.0	0.1562
Tb.N	0.0060	**<.0001**	1.880	1.980	2.088	**<.0001**	0.0074	**<.0001**	1.978	2.054	2.119	**<.0001**
Tb.Th	-0.0001	**0.0009**	0.072	0.072	0.070	0.1036	-0.0001	**0.0039**	0.072	0.071	0.069	**0.0121**
Tt.Ar	0.1562	0.3160	776.5	770.1	769.6	0.4229	-0.0487	0.8965	775.8	777.2	768.3	0.3833
Tt.BMD	0.7033	**<.0001**	259.8	275.3	288.2	**<.0001**	0.8319	**<.0001**	273.3	283.1	289.5	**0.0005**
FL	12.5653	**<.0001**	5980	6274	6496	**<.0001**	14.6088	**0.0001**	6267	6467	6478	**0.0159**
Radius (N=1263)[d]												
Ct.BMD	0.2150	0.0506	943.4	944.9	946.0	0.6808	0.4581	0.0798	941.3	946.1	946.0	0.4410
Ct.Po	-0.0004	0.8773	3.894	4.078	4.001	0.5066	-0.0009	0.8891	4.011	4.050	3.983	0.8556
Ct.Th	0.0019	**<.0001**	0.819	0.844	0.882	**0.0005**	0.0031	**<.0001**	0.835	0.873	0.891	**0.0016**
Tb.BMD	0.3292	**<.0001**	154.8	159.0	166.3	**0.0015**	0.4309	**0.0040**	159.9	163.2	168.7	**0.0113**
Tb.N	0.0041	**<.0001**	1.948	1.991	2.109	**<.0001**	0.0046	**0.0007**	2.011	2.080	2.095	**0.0075**
Tb.Th	0.0000	0.7852	0.066	0.066	0.066	0.6826	0.0000	0.9939	0.066	0.065	0.066	0.7935
Tt.Ar	0.0214	0.7826	307.4	312.1	312.2	0.2757	0.0317	0.8647	314.0	313.0	310.3	0.3903
Tt.BMD	0.6626	**<.0001**	294.3	301.9	315.1	**0.0005**	0.9162	**0.0002**	300.8	310.3	319.0	**0.0016**
FL	3.5057	**<.0001**	2407	2512	2572	**0.0002**	5.0189	**0.0065**	2492	2560	2584	**0.0298**

[a] Long-term (40 year) weight change was determined between the index examination (2011-2014) and enrollment (1971-1974) and expressed as a percentage of the weight at the

[b] Bold indicates p-values <0.05

[c]. Ct.BMD=cortical volumetric bone mineral density, Ct.Po=cortical porosity, Ct.Th=cortical thickness, Tb.BMD=trabecular volumetric bone mineral density, Tb.N=trabecular

[d] The sample includes 1,361 individuals with HR-pQCT measures at the tibia (N=1,328) and/or radius (N=1,263).

[e] Adjusted for age, sex, height, current smoking, and diabetes and **initial weight**

Supplemental Table 2. Association between long-term and recent weight change and HR-pQCT indices at the tibia and radius, adjusted for age, sex, height, current smoking, diabetes. Similar to the analysis shown in Table 3 but **here the covariates information were based on initial/baseline examination** (i.e. baseline = time at enrollment for long-term weight change; and baseline = time at preceeding clinic visit for recent weight change). Beta coefficients are presented for weight change treated as a continuous variable, and least square means are presented for weight change group.

	Weight Change[a]											
	Long-term weight change						*Recent weight change*					
	Continuous		*Catogorical Measure*				*Continuous*		*Catogorical Measure*			
HR--pQCT indices[c]	Beta	P-value[b]	≥5% loss (N=166)	<5% change (N=275)	≥5% gain (N=920)	P-value[b]	Beta	P-value[b]	≥5% loss (N=301)	<5% change (N=834)	≥5% gain (N=226)	P-value[b]
Tibia (N=1328)[d]			Mean[e]						Mean[e]			
Ct.BMD	0.7986	**<.0001**	780.6	786.7	807.5	**<.0001**	1.2011	**<.0001**	834.3	849.2	854.8	**0.0012**
Ct.Po	-0.0146	**0.0111**	12.790	13.096	12.495	0.3373	-0.0398	**0.0023**	10.855	10.446	10.102	**0.0124**
Ct.Th	0.0035	**<.0001**	1.088	1.138	1.210	**<.0001**	0.0039	**<.0001**	1.152	1.189	1.219	**0.0025**
Tb.BMD	0.3441	**<.0001**	136.9	147.0	151.8	**<.0001**	0.2146	0.1356	171.4	174.4	176.4	0.1285
Tb.N	0.0063	**<.0001**	1.680	1.780	1.896	**<.0001**	0.0073	**<.0001**	2.006	2.081	2.147	**<.0001**
Tb.Th	-0.0001	**0.0070**	0.069	0.069	0.067	0.2535	-0.0001	**0.0040**	0.072	0.070	0.069	**0.0157**
Tt.Ar	0.0361	0.8258	753.9	751.1	752.4	0.8647	0.2316	0.5354	773.0	778.2	771.3	0.8416
Tt.BMD	0.7859	**<.0001**	230.3	245.6	259.6	**<.0001**	0.7855	**0.0001**	273.4	282.2	288.8	**0.0009**
FL	13.2809	**<.0001**	5092	5406	5668	**<.0001**	15.1860	**<.0001**	6244	6441	6473	**0.0098**
Radius (N=1263)[d]												
Ct.BMD	0.2925	**0.0111**	918.3	920.4	922.3	0.5291	0.4759	0.0720	937.8	942.3	942.5	0.4401
Ct.Po	-0.0024	0.4210	4.350	4.505	4.408	0.7244	-0.0021	0.7642	4.080	4.122	4.038	0.7895
Ct.Th	0.0020	**<.0001**	0.721	0.743	0.779	**0.0021**	0.0031	**<.0001**	0.833	0.870	0.887	**0.0023**
Tb.BMD	0.3299	**<.0001**	135.3	138.8	146.1	**0.0035**	0.4019	**0.0081**	161.0	163.9	169.4	**0.0163**
Tb.N	0.0044	**<.0001**	1.649	1.689	1.810	**<.0001**	0.0043	**0.0021**	2.031	2.099	2.110	**0.0138**
Tb.Th	0.0000	0.4812	0.069	0.069	0.069	0.5455	0.0000	0.9591	0.066	0.065	0.066	0.7703
Tt.Ar	-0.0047	0.9537	332.3	338.7	340.3	0.0783	0.0854	0.6496	311.7	311.0	309.2	0.5544
Tt.BMD	0.6858	**<.0001**	257.1	262.8	275.5	**0.0026**	0.8693	**0.0006**	301.6	310.8	318.9	**0.0030**
FL	3.3483	**<.0001**	2112	2217	2289	**<.0001**	5.1057	**0.0063**	2491	2556	2585	**0.0279**

[a] Long-term (40 year) weight change was determined between the index examination (2011-2014) and enrollment (1971-1974) and expressed as a percentage of the weight at the

[b] Bold indicates p-values <0.05

[c]. Ct.BMD=cortical volumetric bone mineral density, Ct.Po=cortical porosity, Ct.Th=cortical thickness, Tb.BMD=trabecular volumetric bone mineral density, Tb.N=trabecular

[d] The sample includes 1,361 individuals with HR-pQCT measures at the tibia (N=1,328) and/or radius (N=1,263).

[e] Adjusted for age, sex, height, current smoking, and diabetes, **assessed at initial/baseline examination**

Supplemental Table 3. Association between long-term weight change and HR-pQCT indices at the tibia and radius, adjusted for age, sex, height, current smoking, diabetes and the standard deviation of weight measurements over time. Beta coefficients are presented for weight change treated as a continuous variable, and least square means are presented for weight change group.

HR--pQCT indices[c]	Long-term weight change[a]					
	Continuous		_Catogorical Measure_			
	Beta	P-value[b]	≥5% loss (N=166)	<5% change (N=275)	≥5% gain (N=920)	P-value[b]
Tibia (N=1328)[d]			Mean[e]			
Ct.BMD	0.9493	**<.0001**	833.3	839.1	858.2	**<.0001**
Ct.Po	-0.0277	**<.0001**	10.577	10.820	10.046	0.0681
Ct.Th	0.0033	**<.0001**	1.126	1.176	1.225	**<.0001**
Tb.BMD	0.1136	0.1289	168.2	175.3	174.0	0.0750
Tb.N	0.0019	**0.0079**	1.979	2.066	2.065	**0.0056**
Tb.Th	0.0000	0.5915	0.071	0.071	0.071	0.4780
Tt.Ar	-1.2403	**<.0001**	801.3	789.3	764.7	**<.0001**
Tt.BMD	0.6415	**<.0001**	266.6	280.0	287.2	**<.0001**
FL	4.5794	**0.0264**	6260	6464	6460	**0.0260**
Radius (N=1263)[d]						
Ct.BMD	0.5197	**0.0001**	940.8	942.4	946.8	0.3321
Ct.Po	-0.0065	0.0709	4.018	4.167	3.979	0.8095
Ct.Th	0.0017	**<.0001**	0.836	0.859	0.878	**0.0202**
Tb.BMD	0.2126	**0.0068**	158.4	162.3	165.3	0.0503
Tb.N	0.0027	**0.0002**	1.986	2.029	2.097	**0.0007**
Tb.Th	0.0000	0.6751	0.066	0.066	0.066	0.5447
Tt.Ar	-0.2103	**0.0306**	313.7	315.9	311.6	0.6344
Tt.BMD	0.5664	**<.0001**	299.0	306.7	313.5	**0.0133**
FL	1.5427	0.1224	2481	2564	2559	0.0770

[a] Long-term (40 year) weight change was determined between the index examination (2011-2014) and enrollment (1971-1974) and expressed as a percentage of the weight at the index examination. Recent (6 year) weight change was determined between the index examination and the preceding clinic visit (2005-2008) and expressed as a percentage of the weight at the preceding clinic visit.

[b] Bold indicates p-values <0.05

[c]. Ct.BMD=cortical volumetric bone mineral density, Ct.Po=cortical porosity, Ct.Th=cortical thickness, Tb.BMD=trabecular volumetric bone mineral density, Tb.N=trabecular number, Tt.BMD= total (integral) volumetric bone mineral density, Tt.CSA=total cross-sectional area (Tt.CSA, mm^2), FEA=Micro finite element analysis, and FL=failure load

[d] The sample includes 1,361 individuals with HR-pQCT measures at the tibia (N=1,328) and/or radius (N=1,263).

[e] Adjusted for age, sex, height, current smoking, and diabetes and **the standard deviation of weight measurements over time**

Supplemental Table 4. Association between long-term and recent weight change and HR-pQCT indices at the tibia and radius in men, adjusted for age, sex, height, current smoking, and diabetes. Beta coefficients are presented for weight change treated as a continuous variable, and least square means are presented for weight change group

	Weight Change[a]											
	Long-term weight change						**Recent weight change**					
	Continuous		*Catogorical Measure*				*Continuous*		*Catogorical Measure*			
HR--pQCT indices[c]	Beta	P-value[b]	≥5% loss (N=89)	<5% change (N=149)	≥5% gain (N=356)	P-value[b]	Beta	P-value[b]	≥5% loss (N=122)	<5% change (N=389)	≥5% gain (N=83)	P-value[b]
Tibia (N=580)[d]				Mean[e]						Mean[e]		
Ct.BMD	0.3765	0.0729	854.6	865.4	875.4	**0.014**	0.8285	0.0670	857.9	873.7	870.8	0.186
Ct.Po	-0.0100	0.3145	10.491	10.693	9.990	0.212	-0.0202	0.3478	10.450	10.127	10.264	0.692
Ct.Th	0.0019	**0.0177**	1.262	1.356	1.358	**0.003**	0.0037	**0.0324**	1.308	1.344	1.367	0.115
Tb.BMD	-0.1497	0.1815	186.9	189.9	186.5	0.916	-0.3206	0.1841	190.1	186.2	186.9	0.535
Tb.N	0.0022	**0.0306**	2.176	2.235	2.240	0.118	0.0013	0.5390	2.226	2.210	2.283	0.231
Tb.Th	-0.0001	**0.0008**	0.072	0.071	0.070	0.092	-0.0002	**0.0363**	0.072	0.071	0.068	0.052
Tt.Ar	-0.9320	**0.0071**	929.5	908.1	887.2	**0.002**	-1.4386	0.0544	912.5	902.8	872.9	**0.014**
Tt.BMD	0.1915	0.2369	291.5	305.1	306.1	**0.025**	0.2073	0.5525	300.6	302.8	307.3	0.375
FL	-6.6814	0.0678	7779	7914	7774	0.971	-5.3583	0.4961	7810	7849	7654	0.364
Radius (N=546)[d]												
Ct.BMD	0.0457	0.8030	942.5	938.6	946.1	0.635	-0.0861	0.8253	941.3	948.6	934.0	0.395
Ct.Po	-0.0041	0.4430	4.592	4.684	4.321	0.227	0.0062	0.5842	4.484	4.316	4.737	0.315
Ct.Th	0.0007	0.2988	0.946	0.974	0.982	0.183	0.0031	**0.0204**	0.939	0.975	1.008	**0.021**
Tb.BMD	-0.0166	0.8843	182.6	184.0	184.5	0.691	0.0253	0.9168	183.9	182.3	189.1	0.330
Tb.N	0.0003	0.6829	2.186	2.223	2.240	0.125	-0.0010	0.5648	2.246	2.223	2.213	0.403
Tb.Th	0.0000	0.3862	0.070	0.069	0.069	0.357	0.0000	0.9245	0.069	0.069	0.071	0.149
Tt.Ar	-0.2383	0.1681	373.8	380.8	374.6	0.913	-0.4417	0.2301	385.9	375.0	366.6	**0.019**
Tt.BMD	0.1332	0.4874	326.0	330.2	334.2	0.306	0.5440	0.1825	323.2	332.0	341.2	**0.047**
FL	-1.8066	0.3094	3145	3251	3202	0.443	0.9008	0.8111	3166	3210	3221	0.511

[a] Long-term (40 year) weight change was determined between the index examination (2011-2014) and enrollment (1971-1974) and expressed as a percentage of the weight at the index examination. Recent (6 year) weight change was determined between the index examination and the preceding clinic visit (2005-2008) and expressed as a percentage of the weight at the preceding clinic visit.

[b] Bold indicates p-values <0.05

[c]. Ct.BMD=cortical volumetric bone mineral density, Ct.Po=cortical porosity, Ct.Th=cortical thickness, Tb.BMD=trabecular volumetric bone mineral density, Tb.N=trabecular number, Tt.BMD= total (integral) volumetric bone mineral density, Tt.CSA=total cross-sectional area (Tt.CSA, mm^2), FEA=Micro finite element analysis, and FL=failure load

[d] The male sample includes individuals with HR-pQCT measures at the tibia (N=580) and/or radius (N=546).

[e] Adjusted for age, sex, height, current smoking, and diabetes

Supplemental Table 5. Association between long-term and recent weight change and HR-pQCT indices at the tibia and radius in women, adjusted for age, sex, height, current smoking, and diabetes. Beta coefficients are presented for weight change treated as a continuous variable, and least square means are presented for weight change group

	Weight Change[a]											
	Long-term weight change						*Recent weight change*					
	Continuous		*Catogorical Measure*				*Continuous*		*Catogorical Measure*			
HR--pQCT indices[c]	Beta	P-value[b]	≥5% loss (N=77)	<5% change (N=126)	≥5% gain (N=564)	P-value[b]	Beta	P-value[b]	≥5% loss (N=179)	<5% change (N=445)	≥5% gain (N=143)	P-value[b]
Tibia (N=748)[d]				Mean[e]						Mean[e]		
Ct.BMD	0.7929	**<.0001**	809.7	809.6	838.9	**0.001**	1.1128	**0.0007**	818.2	830.9	838.1	**0.013**
Ct.Po	-0.0193	**0.0020**	10.782	10.915	10.270	0.217	-0.0501	**0.0014**	10.996	10.472	9.830	**0.002**
Ct.Th	0.0030	**<.0001**	0.979	0.967	1.087	**0.000**	0.0023	**0.0377**	1.028	1.050	1.061	0.220
Tb.BMD	0.2914	**<.0001**	150.7	158.3	164.0	**0.004**	0.1777	0.3147	157.9	163.2	161.6	0.381
Tb.N	0.0046	**<.0001**	1.800	1.834	1.959	**0.001**	0.0050	**0.0060**	1.853	1.936	1.939	0.050
Tb.Th	0.0000	0.2713	0.070	0.072	0.070	0.962	-0.0001	0.2289	0.071	0.071	0.070	0.372
Tt.Ar	-0.1128	0.4812	692.8	674.2	671.6	**0.046**	-0.2521	0.5298	676.6	675.0	670.9	0.560
Tt.BMD	0.6909	**<.0001**	240.1	248.4	268.2	**<.0001**	0.6629	**0.0071**	252.8	263.1	264.9	**0.043**
FL	11.8677	**<.0001**	4856	4976	5307	**<.0001**	11.4711	**0.0056**	5056	5231	5235	0.074
Radius (N=717)[d]												
Ct.BMD	0.3088	**0.0201**	937.2	947.2	945.0	0.404	0.7634	**0.0246**	940.2	943.9	951.8	0.155
Ct.Po	-0.0030	0.3527	3.480	3.697	3.747	0.238	-0.0094	0.2506	3.701	3.860	3.417	0.142
Ct.Th	0.0018	**<.0001**	0.727	0.733	0.784	**0.021**	0.0019	**0.0369**	0.748	0.775	0.770	0.314
Tb.BMD	0.3538	**<.0001**	134.3	137.6	147.9	**0.009**	0.4182	**0.0288**	140.4	144.9	147.1	0.142
Tb.N	0.0043	**<.0001**	1.795	1.813	1.990	**0.000**	0.0051	**0.0097**	1.849	1.961	1.958	**0.021**
Tb.Th	0.0000	0.9116	0.062	0.063	0.062	0.949	0.0000	0.8585	0.063	0.062	0.062	0.392
Tt.Ar	-0.0452	0.5474	262.1	256.7	257.3	0.361	0.0644	0.7372	255.4	259.2	257.5	0.652
Tt.BMD	0.6934	**<.0001**	269.9	276.1	293.8	**0.005**	0.7280	**0.0196**	281.5	288.1	292.0	0.162
FL	3.3349	**<.0001**	1863	1886	1974	**0.029**	3.5772	0.0533	1909	1956	1952	0.330

[a] Long-term (40 year) weight change was determined between the index examination (2011-2014) and enrollment (1971-1974) and expressed as a percentage of the weight at the index examination. Recent (6 year) weight change was determined between the index examination and the preceding clinic visit (2005-2008) and expressed as a percentage of the weight at the preceding clinic visit.

[b] Bold indicates p-values <0.05

[c]. Ct.BMD=cortical volumetric bone mineral density, Ct.Po=cortical porosity, Ct.Th=cortical thickness, Tb.BMD=trabecular volumetric bone mineral density, Tb.N=trabecular number, Tt.BMD= total (integral) volumetric bone mineral density, Tt.CSA=total cross-sectional area (Tt.CSA, mm^2), FEA=Micro finite element analysis, and FL=failure load

[d] The female sample includes individuals with HR-pQCT measures at the tibia (N=748) and/or radius (N=717).

[e] Adjusted for age, sex, height, current smoking, and diabetes