

## **Supplementary materials**

Table S1. The association of *FOXO3A* SNPs, residence and mortality after adjusting for PM2.5 and NDVI

Table S2. The association of *FOXO3A* SNPs, residence and mortality in the female

Table S3. The association of *FOXO3A* SNPs, residence and mortality in the male

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Table S5. The association of *FOXO3A* SNPs, residence and mortality in the population aged 85 or older

**Table S1. The association of *FOXO3A* SNPs, residence and mortality after adjusting for PM2.5 and NDVI**

Term	Model: NDVI and PM2.5		Model: FOXO+NDVI and PM2.5		Model: Residence+NDVI and PM2.5		Model: FOXO+Residence+NDVI and PM2.5		Model: FOXO*Residence+NDVI and PM2.5		
	HR (95% CI)	p value	HR (95% CI)	p value	HR (95% CI)	p value	HR (95% CI)	p value	HR (95% CI)	beta (std.error)	p.value
FOXO3A_936 (CC as reference)											
TC			0.979 (0.878, 1.092)	0.709			0.968 (0.868, 1.08)	0.560	0.949 (0.834, 1.079)	-0.052 (0.066)	0.424
TT			0.846 (0.685, 1.045)	0.122			0.843 (0.682, 1.041)	0.113	0.708 (0.541, 0.925)	-0.346 (0.137)	0.011
Residence (Rural as reference)					0.733 (0.648, 0.829)	<0.001	0.732 (0.648, 0.828)	<0.001	0.688 (0.586, 0.808)	-0.374 (0.082)	<0.001
FOXO3A_936 TC * Residence-Urban									1.067 (0.838, 1.36)	0.065 (0.124)	0.597
FOXO3A_936 TT * Residence-Urban									1.695 (1.096, 2.622)	0.528 (0.222)	0.018
NDVI	0.885 (0.861, 0.909)	<0.001	0.885 (0.862, 0.91)	<0.001	0.868 (0.844, 0.893)	<0.001	0.869 (0.845, 0.894)	<0.001	0.87 (0.846, 0.895)	-0.139 (0.014)	<0.001
PM 2.5	1.13 (1.086, 1.175)	<0.001	1.128 (1.085, 1.174)	<0.001	1.132 (1.088, 1.177)	<0.001	1.13 (1.086, 1.176)	<0.001	1.129 (1.085, 1.175)	0.121 (0.02)	<0.001
FOXO3A_292 (TT as reference)											
TG			0.985 (0.883, 1.099)	0.787			0.976 (0.875, 1.089)	0.664	0.969 (0.852, 1.102)	-0.032 (0.066)	0.627
GG			0.833 (0.687, 1.01)	0.063			0.825 (0.681, 1.001)	0.051	0.67 (0.525, 0.856)	-0.4 (0.125)	0.001
Residence (Rural as reference)					0.733 (0.648, 0.829)	<0.001	0.732 (0.647, 0.827)	<0.001	0.684 (0.579, 0.808)	-0.38 (0.085)	<0.001
FOXO3A_292 TG * Residence-Urban									1.021 (0.801, 1.302)	0.021 (0.124)	0.867
FOXO3A_292 GG * Residence-Urban									1.897 (1.273, 2.825)	0.64 (0.203)	0.002
NDVI	0.885 (0.861, 0.909)	<0.001	0.885 (0.862, 0.91)	<0.001	0.868 (0.844, 0.893)	<0.001	0.869 (0.845, 0.894)	<0.001	0.87 (0.846, 0.895)	-0.139 (0.014)	<0.001
PM 2.5	1.13 (1.086, 1.175)	<0.001	1.129 (1.086, 1.174)	<0.001	1.132 (1.088, 1.177)	<0.001	1.131 (1.087, 1.177)	<0.001	1.13 (1.086, 1.176)	0.122 (0.02)	<0.001

Term	Model: NDVI and PM2.5		Model: FOXO+NDVI and PM2.5		Model: Residence+NDVI and PM2.5		Model: FOXO+Residence+NDVI and PM2.5		Model: FOXO*Residence+NDVI and PM2.5		
	HR (95% CI)	p value	HR (95% CI)	p value	HR (95% CI)	p value	HR (95% CI)	p value	HR (95% CI)	beta (std.error)	p.value
FOXO3A_310 (GG as reference)											
GC			0.969 (0.868, 1.081)	0.568			0.96 (0.86, 1.071)	0.461	0.951 (0.836, 1.082)	-0.05 (0.066)	0.45
CC			0.827 (0.683, 1.002)	0.052			0.819 (0.676, 0.992)	0.041	0.666 (0.522, 0.849)	-0.407 (0.124)	0.001
Residence (Rural as reference)					0.733 (0.648, 0.829)	<0.001	0.731 (0.646, 0.827)	<0.001	0.682 (0.578, 0.805)	-0.382 (0.085)	<0.001
FOXO3A_310 GC * Residence-Urban									1.024 (0.803, 1.307)	0.024 (0.124)	0.848
FOXO3A_310 CC * Residence-Urban									1.897 (1.276, 2.822)	0.64 (0.203)	0.002
NDVI	0.885 (0.861, 0.909)	<0.001	0.885 (0.862, 0.91)	<0.001	0.868 (0.844, 0.893)	<0.001	0.869 (0.845, 0.894)	<0.001	0.87 (0.846, 0.895)	-0.139 (0.014)	<0.001
PM 2.5	1.13 (1.086, 1.175)	<0.001	1.129 (1.085, 1.174)	<0.001	1.132 (1.088, 1.177)	<0.001	1.131 (1.087, 1.176)	<0.001	1.13 (1.086, 1.176)	0.122 (0.02)	<0.001

Note: All models adjusted for baseline age, sex, education, marriage, smoking, alcohol drinking, and exercise

**Table S2. The association of *FOXO3A* SNPs, residence and mortality in the female**

Term	n	Model - Residence		Model - FOXO		Model - FOXO +residence		Model - FOXO*residence		
		HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	beta (std.error)	p.value
FOXO3A_936 (CC as reference)	902									
TC	618			0.874 (0.755, 1.011)	0.070	0.863 (0.745, 1)	0.049	0.851 (0.719, 1.009)	-0.161(0.086)	0.063
TT	114			0.716 (0.532, 0.962)	0.027	0.71 (0.528, 0.955)	0.024	0.52 (0.351, 0.772)	-0.653(0.201)	0.001
Residence (Rural as reference)		0.866 (0.74, 1.013)	0.073			0.854 (0.73, 1)	0.05	0.795 (0.648, 0.975)	-0.23(0.104)	0.028
FOXO3A_936 TC * Residence-Urban								1.037 (0.742, 1.449)	0.036(0.171)	0.833
FOXO3A_936 TT * Residence-Urban								2.427 (1.332, 4.423)	0.887(0.306)	0.004
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FOXO3A_292 (TT as reference)	834									
TG	661			0.927 (0.802, 1.07)	0.3	0.917 (0.793, 1.06)	0.241	0.922 (0.779, 1.091)	-0.081(0.086)	0.343
GG	139			0.636 (0.478, 0.845)	0.002	0.629 (0.473, 0.837)	0.001	0.472 (0.325, 0.685)	-0.751(0.19)	<0.001
Residence (Rural as reference)		0.866 (0.74, 1.013)	0.073			0.856 (0.731, 1.002)	0.053	0.813 (0.658, 1.005)	-0.207(0.108)	0.056
FOXO3A_292 TG * Residence-Urban								0.967 (0.697, 1.342)	-0.034(0.167)	0.84
FOXO3A_292 GG * Residence-Urban								2.386 (1.335, 4.265)	0.87(0.296)	0.003
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FOXO3A_310 (GG as reference)	845									
GC	649			0.907 (0.784, 1.048)	0.185	0.898 (0.776, 1.038)	0.145	0.903 (0.763, 1.069)	-0.102(0.086)	0.237
CC	140			0.64 (0.483, 0.849)	0.002	0.634 (0.478, 0.841)	0.002	0.482 (0.334, 0.695)	-0.73(0.187)	<0.001
Residence (Rural as reference)		0.866 (0.74, 1.013)	0.073			0.855 (0.731, 1.001)	0.051	0.814 (0.66, 1.004)	-0.206(0.107)	0.055
FOXO3A_310 GC * Residence-Urban								0.964 (0.693, 1.339)	-0.037(0.168)	0.825
FOXO3A_310 CC * Residence-Urban								2.317 (1.302, 4.126)	0.84(0.294)	0.004

Note: All models adjusted for baseline age, education, marriage, smoking, alcohol drinking, and exercise.

**Table S3. The association of *FOXO3A* SNPs, residence and mortality in the male**

Term	n	Model - Residence		Model - FOXO		Model - FOXO+residence		Model - FOXO*residence		
		HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	beta (std.error)	p.value
FOXO3A_936 (CC as reference)	772									
TC	570			1.047 (0.888, 1.234)	0.586	1.049 (0.89, 1.236)	0.57	1.053 (0.864, 1.284)	0.052(0.101)	0.608
TT	109			0.929 (0.685, 1.259)	0.635	0.926 (0.683, 1.254)	0.618	0.841 (0.582, 1.214)	-0.174(0.187)	0.354
Residence (Rural as reference)		0.806 (0.671, 0.968)	0.021			0.805 (0.67, 0.967)	0.02	0.788 (0.616, 1.008)	-0.239(0.126)	0.058
FOXO3A_936 TC * Residence-Urban								0.987 (0.69, 1.412)	-0.013(0.183)	0.944
FOXO3A_936 TT * Residence-Urban								1.392 (0.729, 2.656)	0.331(0.33)	0.316
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FOXO3A_292 (TT as reference)	718									
TG	587			0.99 (0.838, 1.17)	0.906	0.994 (0.841, 1.175)	0.946	1.014 (0.83, 1.239)	0.014(0.102)	0.894
GG	146			1.048 (0.802, 1.368)	0.732	1.043 (0.799, 1.361)	0.757	0.874 (0.628, 1.215)	-0.135(0.168)	0.422
Residence (Rural as reference)		0.806 (0.671, 0.968)	0.021			0.807 (0.672, 0.969)	0.021	0.77 (0.597, 0.992)	-0.262(0.13)	0.043
FOXO3A_292 TG * Residence-Urban								0.945 (0.655, 1.363)	-0.056(0.187)	0.762
FOXO3A_292 GG * Residence-Urban								1.794 (1.03, 3.125)	0.584(0.283)	0.039
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FOXO3A_310 (GG as reference)	724									
GC	580			0.986 (0.834, 1.165)	0.866	0.99 (0.837, 1.17)	0.904	1.006 (0.823, 1.23)	0.006(0.102)	0.952
CC	147			1.03 (0.789, 1.344)	0.827	1.024 (0.785, 1.337)	0.859	0.853 (0.613, 1.185)	-0.16(0.168)	0.342
Residence (Rural as reference)		0.806 (0.671, 0.968)	0.021			0.807 (0.672, 0.969)	0.021	0.765 (0.594, 0.985)	-0.268(0.129)	0.038
FOXO3A_310 GC * Residence-Urban								0.953 (0.661, 1.375)	-0.048(0.187)	0.799
FOXO3A_310 CC * Residence-Urban								1.839 (1.057, 3.202)	0.609(0.283)	0.031

Note: All models adjusted for baseline age, education, marriage, smoking, alcohol drinking, and exercise.

**Table S4. The association of *FOXO3A* SNPs, residence and mortality in the population aged younger than 85**

Term	n	Model - Residence		Model - FOXO		Model - FOXO+residence		Model - FOXO*residence		
		HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	beta (std.error)	p.value
FOXO3A_936 (CC as reference)	746									
TC	489			0.955 (0.737, 1.238)	0.729	0.946 (0.73, 1.227)	0.677	0.879 (0.656, 1.179)	-0.129(0.15)	0.39
TT	97			0.974 (0.596, 1.591)	0.917	0.967 (0.592, 1.579)	0.892	0.724 (0.39, 1.345)	-0.323(0.316)	0.307
Residence (Rural as reference)	1332	0.691 (0.51, 0.937)	0.017			0.69 (0.509, 0.935)	0.017	0.562 (0.373, 0.847)	-0.577(0.21)	0.006
FOXO3A_936 TC * Residence-Urban								1.408 (0.749, 2.647)	0.342(0.322)	0.289
FOXO3A_936 TT * Residence-Urban								2.787 (0.989, 7.858)	1.025(0.529)	0.053
FOXO3A_292 (TT as reference)	694									
TG	508			0.904 (0.695, 1.176)	0.452	0.902 (0.693, 1.174)	0.443	0.886 (0.66, 1.19)	-0.121(0.151)	0.423
GG	130			1.134 (0.754, 1.705)	0.546	1.121 (0.745, 1.685)	0.584	0.825 (0.494, 1.376)	-0.193(0.261)	0.46
Residence (Rural as reference)	1332	0.691 (0.51, 0.937)	0.017			0.692 (0.511, 0.939)	0.018	0.585 (0.383, 0.892)	-0.537(0.216)	0.013
FOXO3A_292 TG * Residence-Urban								1.087 (0.565, 2.092)	0.083(0.334)	0.804
FOXO3A_292 GG * Residence-Urban								3.009 (1.261, 7.184)	1.102(0.444)	0.013
FOXO3A_310 (GG as reference)	696									
GC	506			0.881 (0.676, 1.146)	0.345	0.879 (0.675, 1.144)	0.337	0.896 (0.667, 1.204)	-0.109(0.151)	0.468
CC	130			1.12 (0.745, 1.683)	0.585	1.107 (0.737, 1.663)	0.624	0.827 (0.496, 1.379)	-0.19(0.261)	0.466
Residence (Rural as reference)	1332	0.691 (0.51, 0.937)	0.017			0.692 (0.511, 0.938)	0.018	0.628 (0.416, 0.948)	-0.465(0.21)	0.027
FOXO3A_310 GC * Residence-Urban								0.901 (0.463, 1.754)	-0.104(0.34)	0.76
FOXO3A_310 CC * Residence-Urban								2.806 (1.182, 6.663)	1.032(0.441)	0.019

Note: All models adjusted for sex, education, marriage, smoking, alcohol drinking, and exercise.

**Table S5. The association of *FOXO3A* SNPs, residence and mortality in the population aged 85 or older**

Term	n	Model - Residence		Model - FOXO		Model - FOXO+residence		Model - FOXO*residence		
		HR (95% CI)	p value	HR (95% CI)	p value	HR (95% CI)	P value	HR (95% CI)	beta (std.error)	p.value
FOXO3A_936 (CC as reference)	928									
TC	699			0.992 (0.88, 1.118)	0.892	0.989 (0.877, 1.115)	0.859	1.004 (0.87, 1.158)	0.004(0.073)	0.959
TT	126			0.874 (0.692, 1.103)	0.256	0.873 (0.691, 1.102)	0.253	0.768 (0.571, 1.033)	-0.263(0.151)	0.081
Residence (Rural as reference)	1753	0.935 (0.822, 1.064)	0.308			0.935 (0.822, 1.064)	0.307	0.928 (0.782, 1.1)	-0.075(0.087)	0.389
FOXO3A_936 TC * Residence-Urban								0.949 (0.729, 1.235)	-0.052(0.134)	0.696
FOXO3A_936 TT * Residence-Urban								1.447 (0.894, 2.342)	0.37(0.246)	0.132
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FOXO3A_292 (TT as reference)	858									
TG	740			1.005 (0.891, 1.132)	0.941	1.003 (0.889, 1.13)	0.966	1.025 (0.889, 1.183)	0.025(0.073)	0.732
GG	155			0.807 (0.649, 1.004)	0.055	0.806 (0.648, 1.002)	0.053	0.677 (0.513, 0.895)	-0.39(0.142)	0.006
Residence (Rural as reference)	1753	0.935 (0.822, 1.064)	0.308			0.934 (0.821, 1.062)	0.299	0.921 (0.771, 1.099)	-0.083(0.091)	0.361
FOXO3A_292 TG * Residence-Urban								0.925 (0.711, 1.202)	-0.078(0.134)	0.559
FOXO3A_292 GG * Residence-Urban								1.679 (1.07, 2.637)	0.518(0.23)	0.024
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FOXO3A_310 (GG as reference)	873									
GC	723			0.998 (0.885, 1.125)	0.973	0.996 (0.883, 1.123)	0.949	1.011 (0.876, 1.166)	0.011(0.073)	0.885
CC	157			0.804 (0.647, 0.999)	0.049	0.802 (0.646, 0.997)	0.047	0.673 (0.511, 0.887)	-0.395(0.141)	0.005
Residence (Rural as reference)	1753	0.935 (0.822, 1.064)	0.308			0.933 (0.821, 1.062)	0.295	0.909 (0.762, 1.084)	-0.095(0.09)	0.289
FOXO3A_310 GC * Residence-Urban								0.95 (0.73, 1.235)	-0.052(0.134)	0.7
FOXO3A_310 CC * Residence-Urban								1.698 (1.084, 2.662)	0.53(0.229)	0.021

Note: All models adjusted for sex, education, marriage, smoking, alcohol drinking, and exercise.