

**Supplementary Table 1.** Baseline resting heart rate (RHR) and mortality in the Melbourne Collaborative Cohort Study (N=41 386)

**A) MALES**

<b>All-cause mortality</b>				<b>Age &amp; sex adjusted</b>				<b>Multivariable analysis 1*</b>				<b>Multivariable analysis 2*~</b>			
<b>RHR (bpm)</b>	<b>N deaths</b>	<b>%</b>	<b>Person-years</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>
<60	1,062	20.63	76,070	1.00					1.00						
60-69	1,920	37.3	132,904	1.11	1.03	1.19	0.008	1.10	1.02	1.18	0.016	1.09	1.01	1.18	0.021
70-79	1,347	26.17	88,435	1.28	1.18	1.39	0.000	1.21	1.11	1.31	0.000	1.19	1.09	1.29	0.000
80-89	566	10.99	28,743	1.65	1.49	1.83	0.000	1.41	1.27	1.57	0.000	1.37	1.23	1.53	0.000
90 +	253	4.91	9,254	2.25	1.96	2.58	0.000	1.88	1.63	2.17	0.000	1.82	1.57	2.10	0.000
<i>Per 10bpm</i>					1.19	1.16	1.22	0.000	1.14	1.11	1.17	0.000	1.13	1.10	1.16
<b>Cancer mortality</b>				<b>Age &amp; sex adjusted</b>				<b>Multivariable analysis 1*</b>				<b>Multivariable analysis 2*~</b>			
<b>RHR (bpm)</b>	<b>N deaths</b>	<b>%</b>	<b>Person-years</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>
<60	374	20	71,453												
60-69	747	39	124,856	1.19	1.05	1.35	0.005	1.17	1.03	1.33	0.015	1.15	1.01	1.30	0.037
70-79	507	27	83,094	1.31	1.15	1.50	0.000	1.23	1.07	1.41	0.003	1.19	1.04	1.37	0.013
80-89	192	10	27,096	1.50	1.26	1.79	0.000	1.32	1.10	1.58	0.002	1.24	1.03	1.49	0.023
90 +	81	4	8,765	1.89	1.49	2.41	0.000	1.62	1.26	2.07	0.000	1.51	1.17	1.96	0.001
<i>Per 10bpm</i>					1.14	1.10	1.19	0.000	1.10	1.05	1.15	0.000	1.08	1.04	1.13
<b>CVD mortality</b>				<b>Age &amp; sex adjusted</b>				<b>Multivariable analysis 1*</b>				<b>Multivariable analysis 2*~</b>			
<b>RHR (bpm)</b>	<b>N deaths</b>	<b>%</b>	<b>Person-years</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>
<60	294	22.9	71,453												
60-69	458	35.67	124,856	0.96	0.83	1.11	0.561	0.97	0.83	1.12	0.667	0.98	0.84	1.15	0.832
70-79	330	25.7	83,094	1.14	0.98	1.34	0.098	1.08	0.92	1.27	0.340	1.08	0.91	1.27	0.390
80-89	137	10.67	27,096	1.44	1.17	1.76	0.000	1.19	0.96	1.47	0.105	1.17	0.94	1.46	0.150
90 +	65	5.06	8,765	2.06	1.58	2.70	0.000	1.68	1.27	2.22	0.000	1.65	1.23	2.20	0.001
<i>Per 10bpm</i>					1.16	1.10	1.22	0.000	1.10	1.04	1.16	0.000	1.09	1.03	1.15
<b>Other-cause mortality</b>				<b>Age &amp; sex adjusted</b>				<b>Multivariable analysis*</b>				<b>Multivariable analysis*~</b>			
<b>RHR (bpm)</b>	<b>N deaths</b>	<b>%</b>	<b>Person-years</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>
<60	253	19.09	71,453												
60-69	465	35.09	124,856	1.15	0.98	1.34	0.078	1.14	0.97	1.33	0.107	1.14	0.97	1.33	0.107
70-79	360	27.17	83,094	1.49	1.27	1.75	0.000	1.38	1.17	1.63	0.000	1.36	1.15	1.61	0.000
80-89	168	12.68	27,096	2.12	1.74	2.57	0.000	1.80	1.47	2.20	0.000	1.77	1.44	2.17	0.000
90 +	79	5.96	8,765	3.04	2.36	3.92	0.000	2.59	1.99	3.36	0.000	2.51	1.92	3.28	0.000
<i>Per 10bpm</i>					1.30	1.24	1.36	0.000	1.24	1.18	1.30	0.000	1.22	1.16	1.29

HR: hazard ratio; CI: confidence interval

\* adjusted for age, sex, country of birth, level of education, waist circumference, alcohol consumption, smoking, physical activity score, alternate healthy eating index, total serum cholesterol, sodium-potassium ratio, caffeine, blood pressure, history of hypertension, angina, asthma and diabetes, ~ multivariable analysis excluding the first 2 years of follow-up

## B) FEMALES

All-cause mortality				Age & sex adjusted			Multivariable analysis 1*			Multivariable analysis 2*~					
RHR (bpm)	N deaths	%	Person-years	HR	95% CI		P	HR	95% CI		P	HR	95% CI		P
<60	535	11.39	58,213	1.00					1.00						1.00
60-69	1,582	33.67	194,966	0.95	0.86	1.05	0.305	0.99	0.89	1.09	0.786	0.99	0.90	1.09	0.844
70-79	1,606	34.18	179,204	1.09	0.99	1.20	0.076	1.08	0.98	1.19	0.138	1.08	0.97	1.19	0.148
80-89	754	16.05	62,987	1.51	1.35	1.68	0.000	1.37	1.23	1.54	0.000	1.37	1.22	1.54	0.000
90 +	221	4.7	16,095	1.62	1.38	1.89	0.000	1.41	1.20	1.66	0.000	1.39	1.18	1.63	0.000
			p-trend				0.000				0.002				0.0032
<b>Per 10bpm</b>					1.16	1.13	1.20	0.000	1.12	1.08	1.15	0.000	1.11	1.08	1.14
Cancer mortality				Age & sex adjusted			Multivariable analysis 1*			Multivariable analysis 2*~					
RHR (bpm)	N deaths	%	Person-years	HR	95% CI		P	HR	95% CI		P	HR	95% CI		P
<60	197	11.47	54,447	1.00					1.00						1.00
60-69	580	33.78	182,088	0.92	0.78	1.08	0.317	0.95	0.80	1.12	0.521	0.94	0.79	1.11	0.441
70-79	592	34.48	167,439	1.05	0.89	1.24	0.544	1.05	0.89	1.23	0.585	1.02	0.86	1.20	0.842
80-89	284	16.54	58,998	1.46	1.21	1.75	0.000	1.40	1.16	1.69	0.000	1.38	1.14	1.66	0.001
90 +	64	3.73	15,094	1.22	0.92	1.62	0.159	1.14	0.85	1.52	0.373	1.08	0.81	1.45	0.596
			p-trend				0.0016				0.0068				0.0037
<b>Per 10bpm</b>					1.12	1.07	1.17	0.000	1.10	1.04	1.15	0.000	1.08	1.03	1.14
CVD mortality				Age & sex adjusted			Multivariable analysis 1*			Multivariable analysis 2*~					
RHR (bpm)	N deaths	%	Person-years	HR	95% CI		P	HR	95% CI		P	HR	95% CI		P
<60	113	11.83	54,447	1.00					1.00						1.00
60-69	328	34.35	182,088	0.96	0.78	1.19	0.726	1.06	0.85	1.31	0.617	1.07	0.86	1.33	0.553
70-79	306	32.04	167,439	1.02	0.82	1.26	0.878	1.04	0.84	1.30	0.711	1.06	0.85	1.33	0.601
80-89	151	15.81	58,998	1.47	1.15	1.88	0.002	1.34	1.04	1.73	0.023	1.33	1.03	1.72	0.031
90 +	57	5.97	15,094	2.01	1.46	2.77	0.000	1.77	1.27	2.46	0.001	1.80	1.29	2.51	0.001
			p-trend				0.0061				0.0936				0.131
<b>Per 10bpm</b>					1.18	1.11	1.26	0.000	1.13	1.06	1.20	0.000	1.13	1.06	1.20
Other-cause mortality				Age & sex adjusted			Multivariable analysis*			Multivariable analysis*~					
RHR (bpm)	N deaths	%	Person-years	HR	95% CI		P	HR	95% CI		P	HR	95% CI		P
<60	137	10.98	54,447	1.00					1.00						1.00
60-69	406	32.53	182,088	0.97	0.80	1.17	0.734	0.98	0.81	1.19	0.859	1.00	0.82	1.22	0.979
70-79	415	33.25	167,439	1.12	0.92	1.35	0.262	1.06	0.87	1.29	0.567	1.08	0.89	1.32	0.433
80-89	209	16.75	58,998	1.65	1.33	2.05	0.000	1.40	1.12	1.75	0.003	1.43	1.14	1.79	0.002
90 +	81	6.49	15,094	2.32	1.77	3.06	0.000	1.90	1.43	2.52	0.000	1.88	1.41	2.51	0.000
			p-trend				0.0018				0.0232				0.1296
<b>Per 10bpm</b>					1.24	1.18	1.31	0.000	1.16	1.10	1.23	0.000	1.16	1.10	1.23

HR: hazard ratio; CI: confidence interval

\* adjusted for age, sex, country of birth, level of education, waist circumference, alcohol consumption, smoking, physical activity score, alternate healthy eating index, total serum cholesterol, sodium-potassium ratio, caffeine, blood pressure, history of hypertension, angina, asthma and diabetes, ~ multivariable analysis excluding the first 2 years of follow-up

**Supplementary Table 2.** Baseline resting heart rate (RHR) and cause-specific mortality risk in the Melbourne Collaborative Cohort Study (N=41 386)

Cause of death	Males					Females				
	N deaths	HR* per 10bpm	95% CI		P	N	HR* per 10bpm	95% CI		P
<b>All cancers</b>	<b>1,901</b>	<b>1.10</b>	<b>1.05</b>	<b>1.15</b>	<b>&lt;0.001</b>	<b>1,717</b>	<b>1.10</b>	<b>1.04</b>	<b>1.15</b>	<b>&lt;0.001</b>
Bladder cancer	45	1.03	0.77	1.37	0.864	24	1.14	0.75	1.73	0.541
Brain cancer	66	0.88	0.68	1.13	0.322	58	0.93	0.71	1.23	0.633
Breast cancer	3	0.85	0.23	3.07	0.801	274	1.16	1.03	1.31	0.017
Colorectal cancer	234	1.10	0.97	1.24	0.139	226	1.28	1.13	1.46	0.000
Kidney cancer	47	1.34	1.04	1.74	0.026	26	1.13	0.76	1.67	0.552
Lung cancer	347	1.22	1.11	1.35	0.000	219	1.11	0.96	1.27	0.149
Lymphoid cancer	231	1.11	0.97	1.26	0.125	184	0.98	0.84	1.14	0.808
Prostate cancer	247	1.07	0.94	1.20	0.308	-	-	-	-	-
Ovarian cancer	-	-	-	-	-	122	0.87	0.71	1.06	0.155
Skin cancer	79	1.10	0.90	1.36	0.349	43	1.06	0.78	1.46	0.701
UADT cancer	70	1.11	0.89	1.38	0.357	48	1.21	0.92	1.59	0.173
Other cancer	532	1.04	0.96	1.14	0.308	493	1.09	0.99	1.19	0.077
<b>All cardiovascular diseases</b>	<b>1,284</b>	<b>1.10</b>	<b>1.04</b>	<b>1.16</b>	<b>&lt;0.001</b>	<b>955</b>	<b>1.13</b>	<b>1.06</b>	<b>1.20</b>	<b>&lt;0.001</b>
Cerebrovascular disease	257	0.98	0.87	1.11	0.731	293	1.07	0.96	1.20	0.234
Coronary heart disease	743	1.12	1.05	1.20	0.001	386	1.13	1.03	1.25	0.012
Other CVD	284	1.15	1.03	1.29	0.012	276	1.17	1.04	1.31	0.008
<b>All non-CVD/non-cancer</b>	<b>1,325</b>	<b>1.24</b>	<b>1.18</b>	<b>1.30</b>	<b>&lt;0.001</b>	<b>1,248</b>	<b>1.16</b>	<b>1.10</b>	<b>1.23</b>	<b>&lt;0.001</b>
External cause	128	1.25	1.06	1.46	0.008	113	1.09	0.91	1.31	0.356
Infectious disease	62	1.29	1.02	1.63	0.034	50	1.23	0.95	1.59	0.117
Mental disorder	101	1.17	0.97	1.42	0.100	139	0.98	0.82	1.17	0.814
Endocrine disorder	183	1.34	1.17	1.53	<0.001	180	1.17	1.02	1.34	0.021
Respiratory disease	302	1.33	1.20	1.48	<0.001	218	1.39	1.24	1.57	<0.001
Other cause	549	1.16	1.07	1.25	<0.001	548	1.12	1.03	1.22	0.008

UADT: Upper aerodigestive tract, HR: hazard ratio; CI: confidence interval

\* adjusted for age, sex, country of birth, level of education, waist circumference, alcohol consumption, smoking, physical activity score, AHEI, total serum cholesterol, sodium-potassium ratio, caffeine, blood pressure, history of hypertension, angina, asthma and diabetes.

**Supplementary Table 3.** Temporal changes in resting heart rate (RHR) and all-cause mortality in the MCCS (N=21 692)

**A) MALES**

<b>All-cause mortality</b>			<b>Age &amp; sex adjusted</b>				<b>Multivariable analysis*</b>			<b>Multivariable analysis*~</b>					
<i>Change in RHR (bpm)</i>	<b>N deaths</b>	<b>%</b>	<b>Person-years</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>
Very large decrease (<-25)	38	2.58	1389.1	1.77	1.27	2.46	0.001	1.31	0.92	1.89	0.137	1.19	0.80	1.77	0.4
Large decrease (-16 to -25)	113	7.67	6538.1	1.17	0.96	1.44	0.127	0.96	0.77	1.19	0.716	0.98	0.78	1.23	0.865
Moderate decrease (-6 to -15)	445	30.19	26723.6	1.24	1.09	1.41	0.001	1.16	1.02	1.33	0.023	1.18	1.03	1.35	0.02
Stable RHR (-5 to +5)	520	35.28	36618.4	1.00								1.00			
Moderate increase (6 to 15)	271	18.39	13953.2	1.24	1.07	1.43	0.005	1.24	1.07	1.44	0.004	1.25	1.07	1.46	0.004
Large increase (16 to 25)	60	4.07	2087.5	1.50	1.15	1.96	0.003	1.45	1.10	1.91	0.008	1.35	1.01	1.82	0.045
Very large increase (>25)	27	1.83	737.7	1.71	1.16	2.52	0.007	1.64	1.10	2.42	0.014	1.73	1.16	2.58	0.007

<b>All-cause mortality</b>			<b>Age &amp; sex adjusted</b>				<b>Multivariable analysis*</b>			<b>Multivariable analysis*~</b>					
<i>Clinical change in RHR</i>	<b>N deaths</b>	<b>%</b>	<b>Person-years</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>
Normal-Normal	799	54.21	52,182	1								1			
High-Normal	271	18.39	15,815	1.27	1.11	1.46	0.001	1.11	0.92	1.35	0.274	1.09	0.89	1.33	0.408
High-High	225	15.26	12,368	1.33	1.15	1.55	<0.001	1.12	0.90	1.39	0.316	1.10	0.87	1.38	0.42
Normal-High	179	12.14	7,683	1.31	1.11	1.54	0.001	1.25	1.06	1.47	0.009	1.22	1.02	1.45	0.026

bpm: beats per minute; normal RHR: < 70bpm; high RHR: ≥70bpm; HR: hazard ratio; CI: confidence interval

\* adjusted for age, sex, country of birth, level of education, waist circumference (baseline & wave2), baseline RHR, alcohol consumption, smoking, physical activity score, AHEI, total serum cholesterol, sodium-potassium ratio, caffeine, blood pressure, hypertension, angina, asthma and diabetes  
 ~ multivariable analysis excluding the first 2 years of follow-up following wave 2

**A) FEMALES**

<b>All-cause mortality</b>				<b>Age &amp; sex adjusted</b>				<b>Multivariable analysis*</b>				<b>Multivariable analysis*~</b>			
<i>Change in RHR (bpm)</i>	<b>N deaths</b>	<b>%</b>	<b>Person-years</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>
Very large decrease (<-25)	22	1.64	1836.7	1.15	0.75	1.76	0.526	0.75	0.47	1.18	0.213	0.80	0.50	1.28	0.347
Large decrease (-16 to -25)	115	8.56	10376.7	1.28	1.05	1.57	0.016	1.04	0.84	1.30	0.719	1.06	0.85	1.33	0.614
Moderate decrease (-6 to -15)	367	27.31	43763.6	0.99	0.86	1.13	0.839	0.91	0.79	1.04	0.165	0.90	0.78	1.04	0.166
Stable RHR (-5 to +5)	515	38.32	55521.1	1.00								1.00			
Moderate increase (6 to 15)	252	18.75	20195.7	1.10	0.95	1.28	0.214	1.12	0.96	1.31	0.135	1.11	0.94	1.30	0.21
Large increase (16 to 25)	49	3.65	3007.5	1.23	0.92	1.65	0.171	1.18	0.88	1.59	0.276	1.14	0.83	1.56	0.422
Very large increase (>25)	24	1.79	622.3	2.33	1.55	3.52	<0.001	2.38	1.57	3.61	<0.001	2.11	1.34	3.33	0.001

<b>All-cause mortality</b>				<b>Age &amp; sex adjusted</b>				<b>Multivariable analysis*</b>				<b>Multivariable analysis*~</b>			
<i>Clinical change in RHR</i>	<b>N deaths</b>	<b>%</b>	<b>Person-years</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>	<b>HR</b>	<b>95% CI</b>		<b>P</b>
Normal-Normal	535	39.81	61,942	1								1			
High-Normal	284	21.13	32,794	1.11	0.97	1.29	0.139	0.96	0.80	1.16	0.695	0.96	0.79	1.17	0.692
High-High	345	25.67	27,706	1.43	1.25	1.63	<0.001	1.17	0.96	1.43	0.113	1.16	0.95	1.43	0.15
Normal-High	180	13.39	12,881	1.34	1.13	1.59	0.001	1.27	1.07	1.51	0.006	1.29	1.08	1.54	0.006

bpm: beats per minute; normal RHR: < 70bpm; high RHR: ≥70bpm; HR: hazard ratio; CI: confidence interval

\* adjusted for age, sex, country of birth, level of education, waist circumference (baseline & wave2), baseline RHR, alcohol consumption, smoking, physical activity score, AHEI, total serum cholesterol, sodium-potassium ratio, caffeine, blood pressure, hypertension, angina, asthma and diabetes

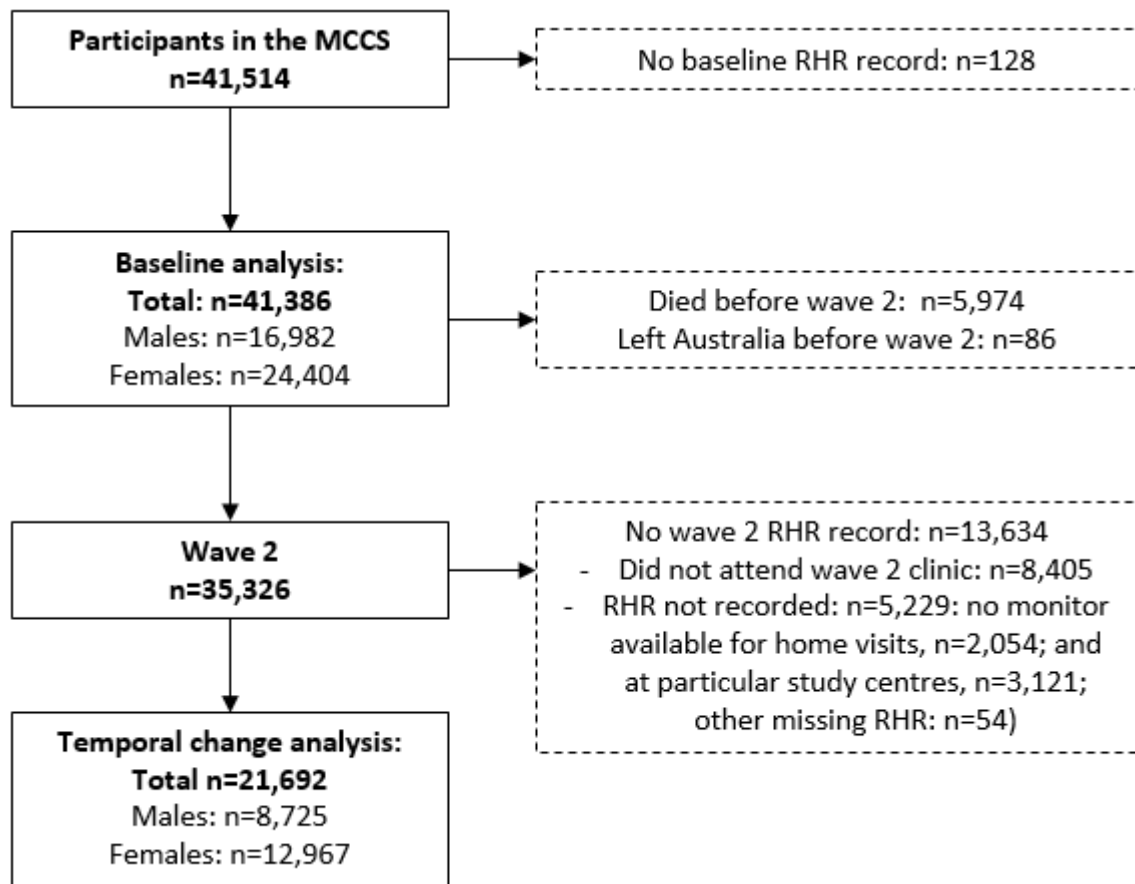
~ multivariable analysis excluding the first 2 years of follow-up following wave 2

**Supplementary Table 4. Temporal changes in resting heart rate (RHR) and cause-specific mortality in the MCCS (N=21,692)**

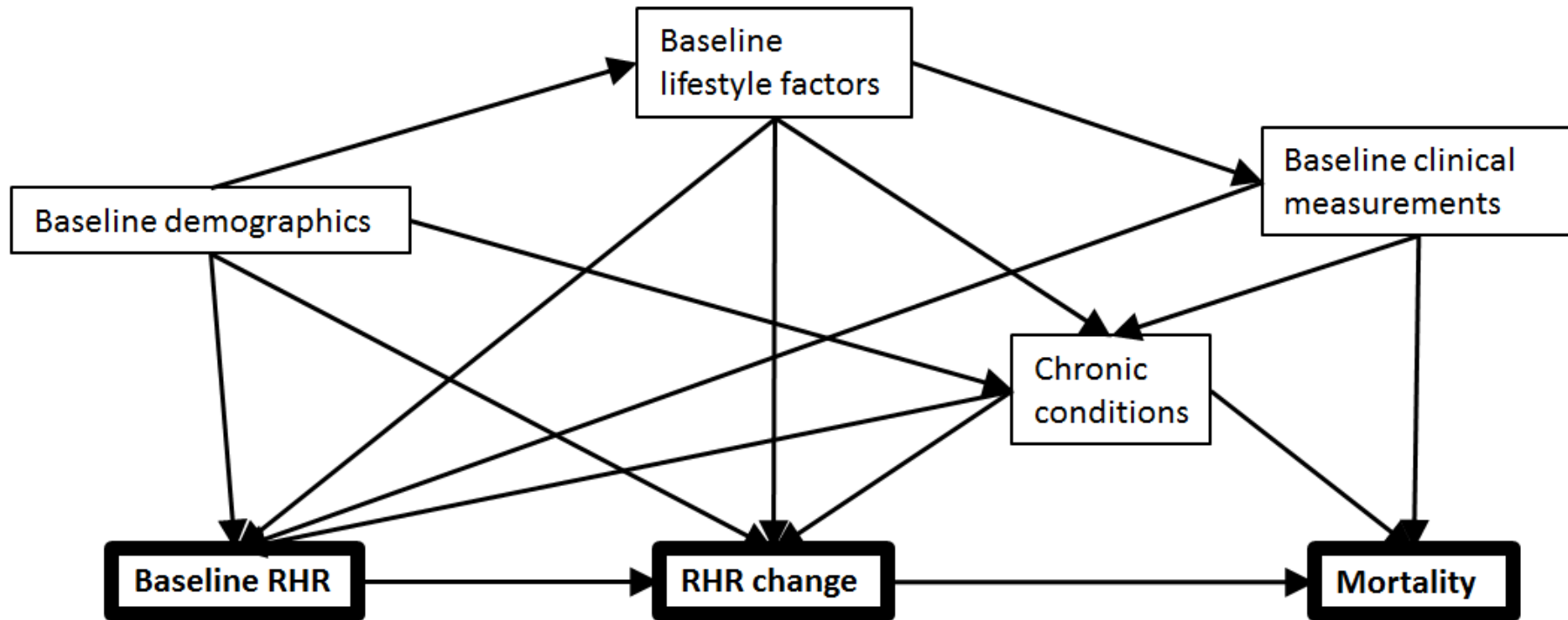
Cause of death		N deaths	HR <sup>a</sup>	95% CI	p
<b>Cancer mortality</b>					
Breast cancer (N=62)	Decrease (>5bpm)	16	0.41	0.22-0.78	0.006
	Increase (>5bpm)	13	1.04	0.54-1.99	0.92
Colorectal cancer (N=89)	Decrease (>5bpm)	34	1.06	0.64-1.76	0.82
	Increase (>5bpm)	20	1.30	0.73-2.29	0.37
Lung cancer (N=149)	Decrease (>5bpm)	56	0.92	0.62-1.35	0.67
	Increase (>5bpm)	32	1.29	0.84-2.00	0.24
Lymphoid cancer (N=108)	Decrease (>5bpm)	33	0.78	0.49-1.25	0.30
	Increase (>5bpm)	28	1.36	0.84-2.19	0.21
Prostate cancer (N=68)	Decrease (>5bpm)	22	0.68	0.37-1.24	0.21
	Increase (>5bpm)	16	1.16	0.62-2.15	0.64
Other cancers (N=286)	Decrease (>5bpm)	118	1.10	0.84-1.45	0.48
	Increase (>5bpm)	50	1.00	0.71-1.40	0.99
<b>CVD mortality</b>					
Cerebro CVD (N=150)	Decrease (>5bpm)	57	0.95	0.65-1.39	0.79
	Increase (>5bpm)	27	0.83	0.52-1.31	0.42
CHD CVD (N=241)	Decrease (>5bpm)	103	1.04	0.77-1.42	0.78
	Increase (>5bpm)	48	1.14	0.80-1.63	0.47
Other CVD (N=173)	Decrease (>5bpm)	68	1.20	0.83-1.74	0.33
	Increase (>5bpm)	45	1.72	1.16-2.55	0.007
<b>Other-cause mortality</b>					
External cause (N=74)	Decrease (>5bpm)	32	1.07	0.62-1.87	0.81
	Increase (>5bpm)	15	1.25	0.66-2.36	0.50
Mental (N=54)	Decrease (>5bpm)	26	1.88	0.98-3.63	0.06
	Increase (>5bpm)	11	1.43	0.66-3.09	0.36
Endocrine (N=68)	Decrease (>5bpm)	29	1.37	0.75-2.51	0.30
	Increase (>5bpm)	18	1.68	0.87-3.22	0.12
Respiratory (N=132)	Decrease (>5bpm)	44	0.87	0.56-1.33	0.52
	Increase (>5bpm)	37	1.71	1.11-2.64	0.02
Other cause (N=261)	Decrease (>5bpm)	98	1.10	0.82-1.47	0.54
	Increase (>5bpm)	61	1.30	0.94-1.80-	0.11

<sup>a</sup> adjusted for age, sex, country of birth, level of education, waist circumference (baseline & wave2), baseline RHR, alcohol consumption, smoking, physical activity score, AHEI, total serum cholesterol, sodium-potassium ratio, caffeine, blood pressure, hypertension, angina, asthma and diabetes. Reference category for each cause was Stable RHR (-5 to 5 bpm).

**Supplementary Figure 1:** Flow chart showing exclusion criteria of the participants in the Melbourne Collaborative Cohort Study.



**Supplementary Figure 2:** Directed acyclic graph showing the causal relationship between change in RHR and all-cause mortality with the potential confounders.



**Demographics:** age, sex, education, country of birth

**Lifestyle factors:** smoking, alcohol consumption, Alternative Healthy Eating Index diet score, caffeine intake, physical activity score and sodium-potassium ratio.

**Chronic conditions:** angina, hypertension, diabetes and asthma

**Clinical measurements:** blood pressure, waist circumference (baseline and wave 2), total serum cholesterol