Adherence to the Korea Cancer Prevention Guideline and Mortality: A Prospective Cohort Study from the Health Examinees-Gem study

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September 27, 2024.

WCE
WORLD CONGRESS OF EPIDEMIOLOGY 2024

The authors have no conflicts of interest to declare for this study.

Top 5 causes of death among Koreans

1.  Cancer (22.4%)
2.  heart disease (9.0%)
3. 

COVID-19 (8.4%)
4.  Pneumonia (7.2%)
5.  Cerebrovascular Disease (6.8%)

Statistics on cause of death from Statistics Korea

Previous study

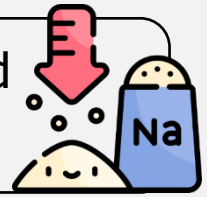
- Following the **2018 WCRF/AICR cancer prevention recommendations** was associated with **lower mortality** in older adults in the United States and Switzerland.
  (Shams-White MM,2022, Suter F,2023)
- Epidemiological studies across various countries have established an association between **health lifestyle habits** (e.g. limiting alcohol consumption, smoking cessation, regular physical activity, maintaining a healthy weight, and a balanced diet) and **mortality risk.** (Khaw KT,2008, Kim JY,2013, Lee DH,2020, Lee I,2019, LianZ,2022, Nechuta SJ,2010, Oh JK, 2023, Tamakoshi A, 2009)

The Korean Cancer Prevention Guidelines

01.Do not smoke, and avoid secondhand smoke

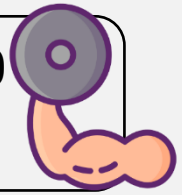
02. Eat plenty of fruits and vegetables, and balanced meals

03. Do not eat salty food and burnt or charred foods

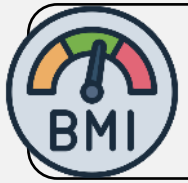


04. Avoid alcohol consumption

05. Walk or exercise at least 30 min/day at least 5 day/week

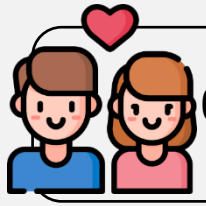


06. Maintain a healthy body weight



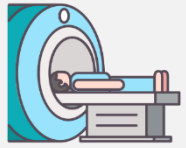
07. Receive vaccination against HBV, HPV

08. Have a safe sexual health



09. Observe safety and health rules

10. Undergo cancer screenings



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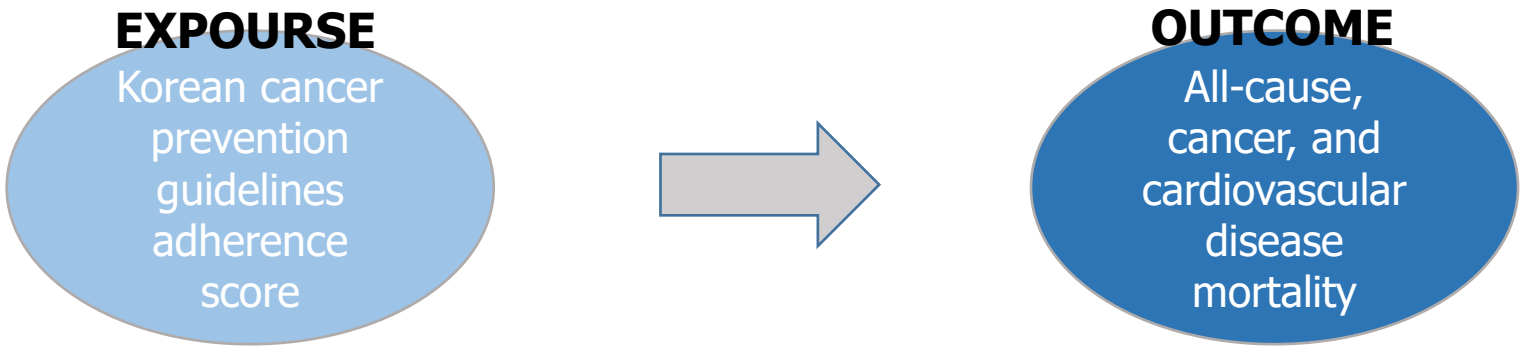
AIM

- To assess the level of adherence to the Korean cancer prevention guidelines among Koreans

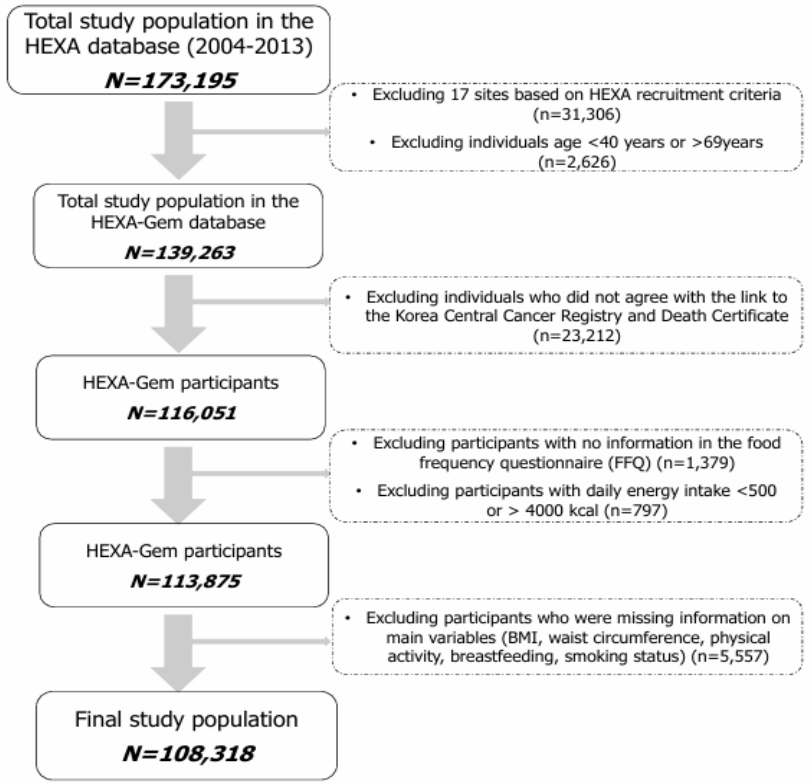
- To investigate the association of Korean cancer prevention guideline scores with the risk of all-cause, cancer, and cardiovascular disease mortality in a large cohort study of Koreans.



Data source:
The Health Examinees Study (HEXA)

- Part of the Korea Genomic Epidemiology Study (KoGES)
- The Health Examinees (HEXA) Study: large-scale genomic community-based prospective cohort study
- Recruitment period: 2004 – 2013
- Total of 108,318 subjects aged 40-69 years
- Follow-up: verified death cases using the death certificate database of the National Statistical Office of Korea until 2021
- Incident overall mortality: 3,799 cases (2,249men and 1,521 women)

Study populations



https://nih.go.kr/ko/main/contents.do?menuNo=300564
Kim et al (2016). Cohort Profile: The Korean Genome and Epidemiology Study (KoGES) Consortium

Exposures: Scoring system

Korea cancer prevention guidelines	Operationalization of Recommendations	Points	Men	Women
Limit smoking: Smoking status	Never	1.0	10069 (26.9)	69193 (96.4)
	Former	0.5	15464 (41.3)	906 (1.3)
	Current	0.0	11881 (31.8)	1647 (2.3)
Eat plenty of vegetables and fruits: Fruits and vegetables (g/day)	≥400	1.0	6075 (16.2)	10570 (14.7)
	200–<400	0.5	16727 (44.7)	31056 (43.3)
	<200	0.0	14612 (39.1)	30120 (42.0)
Eat food without salty: Total Sodium intake (g/mg)	2300-<4100	1.0	16070 (42.9)	27225 (38.0)
	700–<2300, 4100–<5000	0.5	17923 (47.9)	38247 (53.3)
	<700, ≥5000	0.0	3421 (9.2)	6274 (8.7)
Limit alcohol consumption: Total ethanol (g/day)	0	1.0	10649 (28.5)	50367 (70.2)
	>0–≤28 (2 drinks) men and ≤14 (1 drink) women	0.5	20222 (54.1)	19085 (26.6)
	>28 (2 drinks) men and >14 (1 drink) women	0.0	6543 (17.5)	2294 (3.2)
5 or more times a week, 30 minutes or more a day, walking or exercising enough to sweat: Total moderate-vigorous physical activity (min/wk)	≥150	1.0	16245 (43.4)	26986 (37.6)
	75–<150	0.5	3455 (9.2)	6489 (9.0)
	<75	0.0	17714 (47.4)	38271 (53.3)
Maintain a healthy weight: BMI(kg/m2, Waist circumference (cm))	18.5-22.9	0.50	10698 (28.6)	31051 (43.3)
	23.0-24.9	0.25	11259 (30.1)	19072 (26.6)
	<18.5 or ≥25	0.00	15457 (41.3)	21623 (30.1)
	Men: <90, Women: <85	0.5	26609 (71.1)	56951 (79.4)
	Men: ≥90, Women: ≥85	0.0	10805 (28.9)	14795 (20.6)
Hepatitis B and cervical cancer vaccination	Not included			
Have a safe sexual health	Not included			
Observe safety and health rules	Not included			
Have a cancer screening	Not included			

Outcome

- Death cases were identified by linking the death certificate database of the National Statistical Office of Korea

Statistical Analysis

- Cox proportional hazard model (using age as the time scale): estimates the hazard ratio (HR) and 95% confidence intervals (CI)
- Adjusted for education level and total energy intake.

- The median adherence score was 3.0 in men and 4.0 in women.
- During a mean follow-up period of 12.0 years
- 3,799 death cases (2,249 men and 1,550 women)

(n=37414)

Low adherence (0.0-2.5points) → Reference → **High adherence (3.75-6.0points)**

(n=71746)

Low adherence (0.0-2.5points) → Reference → **High adherence (4.5-6.0points)**

- Age ↑
- BMI ↓
- Education level ↑
- Current smoker ↓
- Alcohol intake ↓
- Physical activity ↑
- Energy intake ↑
- Vegetable and fruits intake ↑
- Sodium intake ↑

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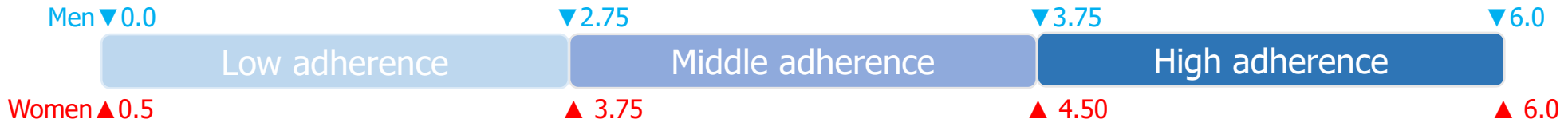
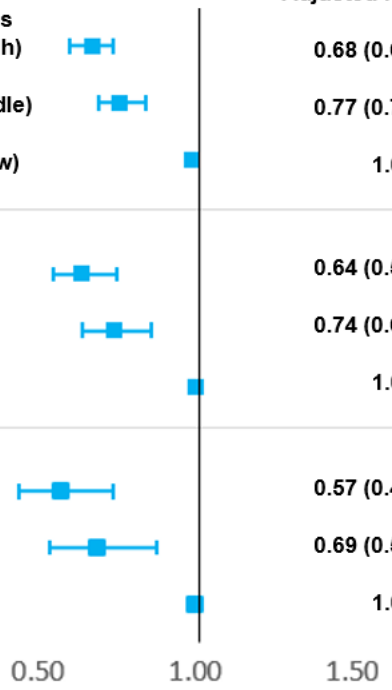


Men

Death/total subjects	Tertile of adherence scores	Adjusted HR (95%CI)	P for trend
All-cause mortality			
627/11328	T3(High)	0.68 (0.61-0.75)	<.001
799/13965	T2(Middle)	0.77 (0.70-0.85)	
823/12121	T1(Low)	1.00	
Cancer mortality			
290/11328	T3	0.64 (0.55-0.75)	<.001
368/13965	T2	0.74 (0.64-0.86)	
383/12121	T1	1.00	
CVD mortality			
95/11328	T3	0.57 (0.44-0.74)	<.001
127/13965	T2	0.69 (0.54-0.88)	
144/12121	T1	1.00	



Women

Death/total subjects	Tertile of adherence scores	Adjusted HR (95%CI)	P for trend
All-cause mortality			
465/23996	T3	0.86 (0.76-0.97)	0.011
385/18986	T2	0.87 (0.77-0.99)	
700/28764	T1	1.00	
Cancer mortality			
276/23996	T3	0.90 (0.76-1.05)	0.173
222/18986	T2	0.91 (0.77-1.07)	
374/28764	T1	1.00	
CVD mortality			
50/23996	T3	0.71 (0.51-0.98)	0.040
60/18986	T2	0.89 (0.65-1.22)	
114/28764	T1	1.00	

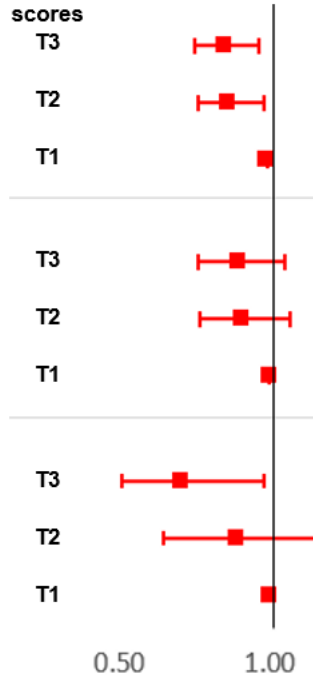


Figure1. Hazard ratios and 95% CI of all-cause, cancer and CVD mortality according to tertile of adherence scores in men and women.

a Adjusted for education level (less than high school, high school, college or above and missing), and total energy intake (tertiles).

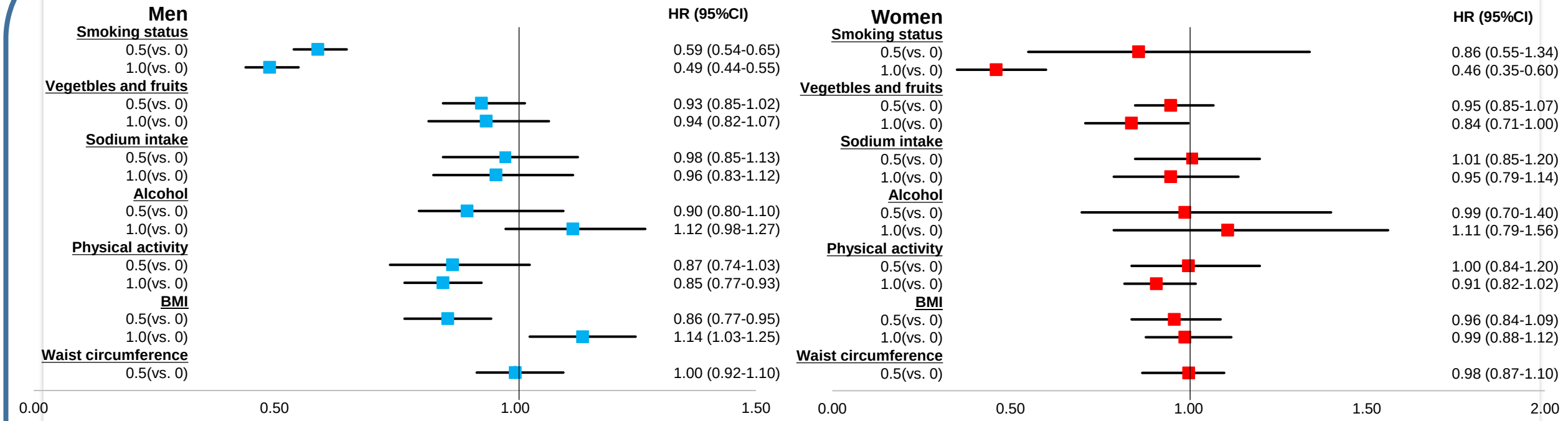


Figure2. Associations between adherence to individual components of the Korean cancer prevention guidelines adherence score and All-cause mortality risk

a Adjusted for education level (less than high school, high school, college or above and missing), and total energy intake (tertiles).

Summary

- Better adherence to Korean cancer prevention guidelines is beneficial in reducing the risk of death among Koreans.
- The Korean cancer prevention guidelines, while primarily aimed at preventing cancer, could serve as valuable tool in reducing the risk of death among Koreans.

Strength &Limitation

- Death conformation within this cohort was validated by the National Statistical Office of Korea, indicating a high level of accuracy in death diagnosis.
- Due to the absence of data, we were unable to use all components of the Korean cancer prevention guidelines.

Acknowledgements

- HEXA study was supported by the National Genome Research Institute, Korea Center for Disease Control and Prevention. We would like to thank the participants and all members of the HEXA Study Group. Additionally, we are grateful to Professors Aesun Shin, Woo-Kyoung Shin, Ji-Yeob Choi, Daehee Kang, and Jong-Koo Lee for their valuable guidance and assistance in the preparation of this manuscript.

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Table 1. Baseline characteristics of the participants according to Korean cancer prevention guidelines adherence score categories and sex.

	Men(n=37414)			Women(n=71746)		
	Tertile1	Tertile2	Tertile3	Tertile1	Tertile2	Tertile3
Score range	0.00-2.50	2.75-3.50	3.75-6.00	0.50-3.50	3.75-4.25	4.50-6.00
No. of participants	12121(32.4)	13965(37.3)	11328(30.3)	28764(40.1)	18986(26.5)	23996(33.5)
Age(year)	52.3±8.3	53.7±8.4	55.2±8.3	52.4±8.0	52.4±7.7	52.4±7.5
Body mass index (kg/m^2)	25.3±3.0	24.3±2.7	23.5±2.2	24.5±3.4	23.5±2.4	22.6±2.4
Education						
≤Middle school	2775 (22.9)	2805 (20.1)	2076 (18.3)	11729 (40.8)	6765 (35.6)	7109 (29.6)
High school	5142 (42.4)	5751 (41.2)	4353 (38.4)	11571 (40.2)	8292 (43.7)	11201 (46.7)
≥College	4087 (33.7)	5299 (37.9)	4799 (42.4)	5225 (18.2)	3788 (20.0)	5522 (23.0)
missing	117 (1.0)	110 (0.8)	100 (0.9)	239 (0.8)	141 (0.7)	164 (0.7)
Income (₩10,000)						
<200	2973 (24.5)	3372 (24.2)	2706 (23.9)	9929 (34.5)	5468 (28.8)	6041 (25.2)
200-400	5233 (43.2)	6067 (43.4)	4826 (42.6)	10773 (37.5)	7586 (40.0)	9748 (40.6)
≥400	3266 (26.9)	3797 (27.2)	3145 (27.8)	6002 (20.9)	4586 (24.2)	6429 (26.8)
missing	649 (5.4)	729 (5.2)	651 (5.8)	2060 (7.2)	1346 (7.1)	1778 (7.4)
Smoking habits						
Never	1054 (8.7)	3455 (24.7)	5560 (49.1)	26628 (92.6)	18686 (98.4)	23879 (99.5)
Former	4255 (35.1)	6460 (46.3)	4749 (41.9)	653 (2.3)	174 (0.9)	79 (0.3)
Current	6812 (56.2)	4050 (29.0)	1019 (9.0)	1483 (5.2)	126 (0.7)	38 (0.2)
Alcohol intake, (g of ethanol/d)	24.1±43.2	13.9±26.0	7.1±17.0	3.3±27.7	1.4±5.1	0.7±3.3
Physical activity						
<75	9371 (77.3)	6459 (46.3)	1884 (16.6)	23833 (82.9)	9622 (50.7)	4816 (20.1)
75- <150 mn/wk	946 (7.8)	1503 (10.8)	1006 (8.9)	1970 (6.9)	2292 (12.1)	2227 (9.3)
≥150 mn/wk	1804 (14.9)	6003 (43.0)	8438 (74.5)	2961 (10.3)	7072 (37.3)	16953 (70.7)
Energy intake, kcal/d	1773.7±512.7	1846±488.6	1912.8±478.0	1564.8±485.8	1718.5±509.4	1809.6±494.2
Vegetable and fruits intake, g/d	214.6±176.0	270.0±178.9	326.0±169.2	191±157.1	272.9±181.6	334.1±169.3
Sodium intake, g/d	2263.1±1514.7	2665.5±1411.9	3025.8±1209.3	1878.1±1281.3	2512.1±1379.7	2910.1±1115.8

The distribution of variables was reported as n (%) and Means ± SD

Table 3. Associations between adherence to individual components of the Korean cancer prevention guidelines adherence score and All-cause mortality risk

Components of the cancer prevention guideline score	Men (n=37414)				Women (n=71746)			
	No.of cases/total participants	Person year	Crude HR (95%CI)	Adjusted HR(95%CI)[a]	No.of cases/total participants	Person year	Crude HR (95%CI)	Adjusted HR(95%CI)[a]
Smoking status								
0	848/11881	140682.0	1.00	1.00	54/1625	19142.2	1.00	1.00
0.5	907/15464	183111.9	0.57 (0.52-0.63)	0.59 (0.54-0.65)	30/892	10604.0	0.85 (0.54-1.33)	0.86 (0.55-1.34)
1	494/10069	122165.7	0.47 (0.42-0.53)	0.49 (0.44-0.55)	1437/68387	824749.1	0.45 (0.34-0.59)	0.46 (0.35-0.60)
Eat plenty of vegetables and fruits								
0	942/14612	173614.7	1.00	1.00	675/29769	356348.0	1.00	1.00
0.5	965/16727	198806.0	0.91 (0.84-1.00)	0.93 (0.85-1.02)	647/30749	369268.9	0.94 (0.85-1.05)	0.95 (0.85-1.07)
1	342/6075	73538.9	0.88 (0.78-1.00)	0.94 (0.82-1.07)	199/10386	128878.4	0.82 (0.70-0.96)	0.84 (0.71-1.00)
Eat food without salty								
0	225/3421	41618.3	1.00	1.00	150/6274	78129.5	1.00	1.00
0.5	1099/17923	212675.3	0.97 (0.84-1.12)	0.98 (0.85-1.13)	849/38247	458538.5	1.01 (0.85-1.20)	1.01 (0.85-1.20)
1	925/16070	191666.0	0.94 (0.82-1.09)	0.96 (0.83-1.12)	551/27225	329428.8	0.93 (0.78-1.12)	0.95 (0.79-1.14)
Limit alcohol consumption								
0	373/6543	77728.2	1.00	1.00	36/2294	27308.6	1.00	1.00
0.5	1073/20222	241597.2	0.81 (0.72-0.91)	0.90 (0.80-1.01)	285/19085	229024.4	0.83 (0.59-1.18)	0.99 (0.70-1.40)
1	803/10649	126634.1	0.95 (0.84-1.07)	1.12 (0.98-1.27)	1229/50367	609763.7	0.91 (0.65-1.27)	1.11 (0.79-1.56)
Be physically active								
0	1182/17714	211645.8	1.00	1.00	864/38271	464082.6	1.00	1.00
0.5	159/3455	41653.8	0.75 (0.63-0.88)	0.87 (0.74-1.03)	139/6489	79031.6	0.98 (0.82-1.17)	1.00 (0.84-1.20)
1	908/16245	192659.9	0.72 (0.66-0.79)	0.85 (0.77-0.93)	547/26986	322982.5	0.89 (0.80-0.99)	0.91 (0.82-1.02)
Be a healthy weight(BMI)								
0	883/15457	184366.5	1.00	1.00	558/21623	260312.7	1.00	1.00
0.25	589/11259	134793.9	0.87(0.78-0.96)	0.86(0.77-0.95)	423/19072	231376.4	0.95 (0.83-1.07)	0.96 (0.84-1.09)
0.5	777/10698	126799.1	1.19(1.08-1.31)	1.14(1.03-1.25)	569/31051	374407.7	0.98 (0.87-1.10)	0.99 (0.88-1.12)
Be a healthy weight(Waist circumference)								
0	686/10805	129739.0	1.00	1.00	440/14795	179679.4	1.00	1.00
0.5	1563/26609	316220.6	1.01 (0.92-1.10)	1.00 (0.92-1.10)	1110/56951	686417.3	0.96 (0.86-1.07)	0.98 (0.87-1.10)

a Adjusted for education level (less than high school, high school, college or above and missing), and total energy intake (tertiles).