

## SUPPLEMENTAL MATERIAL

**Supplemental Table 1:** Total mortality According to Type of Sugar Sweetened Beverage (SSB) based on pooled data from the Nurses' Health Study (NHS) and Health Professionals Follow-up Study (HPFS)

	SSB Category					P trend	HR (95% CI) per 1 serving per day
	<1/mo	1-4/mo	2-6/wk	1 to <2/d	≥ 2/d		
<b>Carbonated cola sweetened beverage</b>							
Number of cases	24511	6040	4413	971	501		
Person years	2186676	642098	429527	102647	54616		
Age-adjusted model	1.0	1.11 (1.07, 1.14)	1.22 (1.18, 1.26)	1.48 (1.38, 1.58)	1.81 (1.66, 1.98)	<0.0001	1.24 (1.22, 1.27)
Multivariate model 1	1.0	1.05 (1.02, 1.08)	1.11 (1.07, 1.15)	1.18 (1.11, 1.26)	1.31 (1.20, 1.43)	<0.0001	1.10 (1.07, 1.13)
Multivariate model 2	1.0	1.02 (0.99, 1.05)	1.06 (1.03, 1.10)	1.12 (1.05, 1.19)	1.23 (1.12, 1.34)	<0.0001	1.07 (1.04, 1.10)
<b>Non-cola carbonated sweetened beverage</b>							
Number of cases	27652	5864	2469	339	112		
Person years	2505009	655386	218586	27960	8621		
Age-adjusted model	1.0	1.01 (0.98, 1.04)	1.12 (1.07, 1.18)	1.29 (1.15, 1.44)	1.57 (1.30, 1.90)	<0.0001	1.22 (1.17, 1.28)
Multivariate model 1	1.0	0.99 (0.96, 1.02)	1.08 (1.03, 1.13)	1.10 (0.99, 1.22)	1.24 (1.03, 1.49)	<0.0001	1.11 (1.06, 1.17)
Multivariate model 2	1.0	0.98 (0.95, 1.01)	1.06 (1.02, 1.11)	1.06 (0.95, 1.18)	1.17 (0.97, 1.41)	0.0007	1.08 (1.03, 1.13)
<b>Non-carbonated sweetened beverage</b>							
Number of cases	24671	6827	3690	819	429		
Person years	2220437	745819	343040	70813	35452		
Age-adjusted model	1.0	0.92 (0.90, 0.95)	0.94 (0.91, 0.97)	1.05 (0.98, 1.12)	1.14 (1.03, 1.25)	0.01	1.05 (1.02, 1.08)
Multivariate model 1	1.0	1.02 (1.00, 1.05)	1.05 (1.01, 1.09)	1.15 (1.07, 1.23)	1.21 (1.10, 1.33)	<0.0001	1.09 (1.06, 1.12)
Multivariate model 2	1.0	1.01 (0.98, 1.04)	1.04 (1.00, 1.08)	1.13 (1.05, 1.21)	1.17 (1.06, 1.29)	<0.0001	1.07 (1.04, 1.10)

Multivariate model 1: adjusted for: age, ASB, smoking, alcohol intake, postmenopausal hormone use (NHS), physical activity, family

history of diabetes, family history of mi, family history of cancer, multivitamin use, ethnicity, aspirin use.

Multivariate model 2: further adjusted for baseline history of hypertension and hypercholesterolemia, intakes of whole grains, fruit, vegetables, red and processed meat, ASB, total energy and BMI. Models were mutually adjusted for different types of SSBs.

**Supplemental Table 2:** Total and Cause-specific Mortality According to Intake of Artificially Sweetened Beverages (ASB) at higher levels based on data of the Nurses' Health Study (NHS) and Health Professionals Follow-up study (HPFS)

	ASB Category						P trend
	<1/mo	1-4/mo	2-6/wk	1 to <2/d	2 to <4/d	≥ 4/d	
<b>Total Mortality</b>							
<b>NHS</b>							
Number of cases	12561	3550	3981	1858	1195	287	
Person years	1122996	408370	514864	260369	163599	32009	
Age-adjusted model	1.0	0.88 (0.85, 0.92)	0.91 (0.88, 0.94)	1.04 (0.99, 1.09)	1.25 (1.18, 1.33)	1.82 (1.62, 2.04)	<0.0001
Multivariate model 1	1.0	0.98 (0.94, 1.02)	0.98 (0.95, 1.02)	1.03 (0.98, 1.09)	1.15 (1.09, 1.22)	1.45 (1.29, 1.63)	<0.0001
Multivariate model 2	1.0	0.96 (0.93, 1.00)	0.94 (0.91, 0.98)	0.97 (0.93, 1.02)	1.06 (1.00, 1.13)	1.30 (1.15, 1.46)	0.0001
<b>HPFS</b>							
Number of cases	7037	1431	3059	866	493	118	
Person Years	434859	96830	231310	82933	54966	12458	
Age-adjusted model	1.0	0.91 (0.86, 0.96)	0.98 (0.94, 1.02)	1.04 (0.97, 1.12)	1.09 (0.99, 1.19)	1.42 (1.18, 1.70)	<0.0001
Multivariate model 1	1.0	0.95 (0.90, 1.01)	1.02 (0.98, 1.06)	1.05 (0.97, 1.12)	1.04 (0.95, 1.14)	1.26 (1.05, 1.51)	0.01
Multivariate model 2	1.0	0.95 (0.89, 1.00)	1.00 (0.95, 1.04)	0.98 (0.91, 1.06)	0.96 (0.87, 1.05)	1.11 (0.93, 1.34)	0.81
<b>Pooled</b>							
Age-adjusted model	1.0	0.89 (0.86, 0.91)	0.94 (0.91, 0.97)	1.04 (1.00, 1.08)	1.20 (1.14, 1.26)	1.68 (1.52, 1.85)	<0.0001
Multivariate model 1	1.0	0.97 (0.94, 1.00)	1.00 (0.97, 1.03)	1.04 (1.00, 1.08)	1.12 (1.06, 1.18)	1.38 (1.25, 1.52)	<0.0001
Multivariate model 2	1.0	0.96 (0.93, 0.99)	0.97 (0.95, 1.00)	0.98 (0.94, 1.03)	1.04 (0.99, 1.09)	1.25 (1.13, 1.38)	0.0002
<b>CVD Mortality</b>							
<b>NHS</b>							
Number of cases	2222	613	691	331	225	57	
Age-adjusted model	1.0	0.87 (0.79, 0.95)	0.92 (0.84, 1.00)	1.10 (0.98, 1.24)	1.48 (1.28, 1.70)	2.33 (1.79, 3.04)	<0.0001
Multivariate model 1	1.0	0.96 (0.87, 1.05)	0.99 (0.91, 1.08)	1.09 (0.97, 1.23)	1.33 (1.16, 1.53)	1.79 (1.37, 2.33)	<0.0001
Multivariate model 2	1.0	0.90 (0.82, 0.99)	0.89 (0.82, 0.98)	0.95 (0.84, 1.07)	1.09 (0.95, 1.26)	1.43 (1.10, 1.87)	0.02
<b>HPFS</b>							
Number of cases	1975	436	882	280	149	35	
Age-adjusted model	1.0	0.97 (0.88, 1.08)	1.03 (0.95, 1.12)	1.28 (1.13, 1.45)	1.30 (1.09, 1.53)	1.75 (1.25, 2.45)	<0.0001
Multivariate model 1	1.0	1.01 (0.91, 1.12)	1.06 (0.97, 1.14)	1.27 (1.12, 1.45)	1.21 (1.03, 1.44)	1.55 (1.11, 2.17)	<0.0001

Multivariate model 2	1.0	0.97 (0.87, 1.08)	0.99 (0.91, 1.07)	1.11 (0.97, 1.26)	1.03 (0.86, 1.22)	1.21 (0.86, 1.70)	0.23
<b>Pooled</b>							
Age-adjusted model	1.0	0.91 (0.85, 0.97)	0.98 (0.92, 1.03)	1.18 (1.08, 1.29)	1.40 (1.26, 1.56)	2.07 (1.68, 2.55)	<0.0001
Multivariate model 1	1.0	0.98 (0.91, 1.05)	1.02 (0.97, 1.09)	1.17 (1.07, 1.27)	1.28 (1.15, 1.43)	1.69 (1.37, 2.08)	<0.0001
Multivariate model 2	1.0	0.93 (0.87, 1.00)	0.95 (0.89, 1.00)	1.02 (0.94, 1.12)	1.08 (0.97, 1.21)	1.37 (1.11, 1.69)	0.004
<b>Cancer Mortality</b>							
<b>NHS</b>							
Number of cases	4154	1334	1520	730	478	102	
Age-adjusted model	1.0	0.93 (0.87, 0.99)	0.91 (0.86, 0.97)	1.01 (0.93, 1.09)	1.17 (1.06, 1.29)	1.41 (1.15, 1.71)	<0.0001
Multivariate model 1	1.0	1.03 (0.97, 1.09)	0.99 (0.93, 1.05)	1.04 (0.96, 1.12)	1.11 (1.01, 1.23)	1.21 (0.99, 1.47)	0.02
Multivariate model 2	1.0	1.00 (0.94, 1.07)	0.95 (0.89, 1.01)	0.98 (0.91, 1.06)	1.04 (0.94, 1.15)	1.12 (0.92, 1.37)	0.34
<b>HPFS</b>							
Number of cases	2118	469	996	283	158	38	
Age-adjusted model	1.0	0.99 (0.89, 1.09)	1.01 (0.93, 1.09)	1.01 (0.89, 1.15)	1.01 (0.85, 1.18)	1.27 (0.92, 1.75)	0.34
Multivariate model 1	1.0	1.02 (0.92, 1.13)	1.05 (0.97, 1.13)	1.03 (0.91, 1.17)	0.98 (0.83, 1.16)	1.16 (0.84, 1.60)	0.68
Multivariate model 2	1.0	1.01 (0.92, 1.12)	1.03 (0.95, 1.11)	0.99 (0.87, 1.13)	0.93 (0.79, 1.10)	1.06 (0.76, 1.46)	0.65
<b>Pooled</b>							
Age-adjusted model	1.0	0.94 (0.89, 0.99)	0.95 (0.90, 0.99)	1.01 (0.95, 1.08)	1.13 (1.04, 1.22)	1.37 (1.16, 1.62)	<0.0001
Multivariate model 1	1.0	1.03 (0.97, 1.08)	1.01 (0.97, 1.06)	1.04 (0.97, 1.11)	1.08 (0.99, 1.17)	1.19 (1.01, 1.41)	0.02
Multivariate model 2	1.0	1.01 (0.96, 1.07)	0.99 (0.94, 1.04)	1.00 (0.93, 1.07)	1.02 (0.94, 1.11)	1.12 (0.95, 1.33)	0.38

Multivariate model 1: adjusted for: age, smoking, alcohol intake, postmenopausal hormone use (NHS), physical activity, family

history of diabetes, family history of myocardial infarction, family history of cancer, multivitamin use, ethnicity, aspirin use.

Multivariate model 2: further adjusted for baseline history of hypertension and hypercholesterolemia, intakes of whole grains, fruit, vegetables, red and processed meat, total energy and body mass index. All models adjusted for sugar-sweetened beverages.

**Supplemental Table 3:** Sensitivity Analysis for Total and Cause-specific Mortality According to Intake of Sugar- Sweetened Beverages (SSB) and Artificially Sweetened Beverages (ASB) based on pooled data from the Nurses' Health Study (NHS) and Health Professionals Follow-up study (HPFS)

	Category					P trend	HR (95% CI) per 1 serving per day increment
	<1/mo	1-4/mo	2-6/wk	1 to <2/d	≥ 2/d		
<b>SSB</b>							
<b>Simple update without stopping updating diet with chronic diseases</b>							
All-cause Mortality	1.0	1.00 (0.97, 1.03)	1.04 (1.02, 1.07)	1.14 (1.09, 1.20)	1.22 (1.14, 1.30)	<0.0001	1.08 (1.06, 1.10)
CVD Mortality	1.0	0.98 (0.93, 1.05)	1.01 (0.95, 1.07)	1.08 (0.97, 1.20)	1.15 (0.99, 1.33)	0.01	1.07 (1.03, 1.12)
Cancer Mortality	1.0	1.06 (1.01, 1.11)	1.10 (1.05, 1.15)	1.12 (1.03, 1.22)	1.26 (1.13, 1.40)	<0.0001	1.07 (1.04, 1.11)
<b>Cumulative Average Intake</b>							
All-cause Mortality	1.0	0.96 (0.94, 0.99)	0.99 (0.96, 1.02)	1.08 (1.03, 1.13)	1.19 (1.10, 1.28)	<0.0001	1.07 (1.05, 1.09)
CVD Mortality	1.0	1.00 (0.94, 1.06)	1.00 (0.95, 1.06)	1.09 (0.98, 1.21)	1.29 (1.10, 1.52)	0.0005	1.10 (1.06, 1.15)
Cancer Mortality	1.0	0.93 (0.89, 0.98)	0.97 (0.93, 1.01)	1.06 (0.97, 1.15)	1.03 (0.90, 1.17)	0.04	1.03 (1.00, 1.07)
<b>Baseline Intake</b>							
All-cause Mortality	1.0	0.96 (0.94, 0.99)	1.00 (0.98, 1.03)	1.06 (1.01, 1.10)	1.15 (1.09, 1.22)	<0.0001	1.05 (1.03, 1.07)
CVD Mortality	1.0	1.03 (0.97, 1.09)	1.03 (0.97, 1.09)	1.15 (1.05, 1.26)	1.21 (1.07, 1.37)	0.0001	1.07 (1.04, 1.11)
Cancer Mortality	1.0	0.97 (0.93, 1.02)	1.02 (0.97, 1.07)	1.04 (0.97, 1.11)	1.04 (0.95, 1.15)	0.08	1.02 (0.99, 1.04)
<b>8-year lagged analysis</b>							
All-cause Mortality	1.0	0.96 (0.93, 0.99)	1.01 (0.97, 1.04)	1.02 (0.96, 1.07)	1.11 (1.04, 1.20)	0.0002	1.05 (1.02, 1.07)
CVD Mortality	1.0	0.92 (0.86, 0.99)	0.95 (0.89, 1.02)	1.01 (0.90, 1.14)	1.09 (0.91, 1.29)	0.15	1.05 (1.00, 1.10)
Cancer Mortality	1.0	0.98 (0.93, 1.04)	1.01 (0.95, 1.06)	1.00 (0.91, 1.10)	1.08 (0.95, 1.23)	0.13	1.04 (1.00, 1.07)
<b>Adjusting for AHEI instead of foods</b>							
All-cause Mortality	1.0	1.00 (0.97, 1.03)	1.04 (1.01, 1.07)	1.12 (1.07, 1.17)	1.19 (1.12, 1.27)	<0.0001	1.07 (1.05, 1.09)
CVD Mortality	1.0	1.06 (0.99, 1.12)	1.09 (1.03, 1.16)	1.18 (1.07, 1.30)	1.30 (1.14, 1.49)	<0.0001	1.09 (1.06, 1.14)
Cancer Mortality	1.0	1.03 (0.98, 1.08)	1.05 (1.00, 1.11)	1.11 (1.03, 1.20)	1.15 (1.03, 1.27)	0.001	1.04 (1.01, 1.07)
<b>ASB</b>							

<b>Simple update without stopping updating diet with chronic diseases</b>							
All-cause Mortality	1.0	0.94 (0.91, 0.97)	0.96 (0.93, 0.99)	0.94 (0.90, 0.98)	1.00 (0.95, 1.05)	0.51	1.00 (0.98, 1.01)
CVD Mortality	1.0	0.91 (0.85, 0.98)	0.94 (0.89, 1.00)	0.96 (0.87, 1.06)	1.01 (0.90, 1.13)	0.93	1.01 (0.98, 1.05)
Cancer Mortality	1.0	0.98 (0.92, 1.03)	0.96 (0.92, 1.00)	0.88 (0.81, 0.94)	0.95 (0.87, 1.03)	0.01	0.96 (0.94, 0.98)
<b>Cumulative Average Intake</b>							
All-cause Mortality	1.0	0.94 (0.91, 0.97)	0.93 (0.91, 0.95)	0.94 (0.90, 0.95)	1.03 (0.98, 1.08)	0.71	1.02 (1.00, 1.03)
CVD Mortality	1.0	0.90 (0.84, 0.96)	0.90 (0.85, 0.95)	0.92 (0.84, 1.00)	1.12 (1.00, 1.24)	0.15	1.04 (1.00, 1.07)
Cancer Mortality	1.0	0.90 (0.85, 0.95)	0.88 (0.84, 0.92)	0.89 (0.83, 0.95)	0.91 (0.84, 1.00)	0.03	0.98 (0.96, 1.01)
<b>Baseline Intake</b>							
All-cause Mortality	1.0	0.95 (0.92, 0.98)	0.94 (0.91, 0.97)	0.95 (0.92, 0.99)	0.99 (0.95, 1.04)	0.76	1.01 (0.99, 1.02)
CVD Mortality	1.0	0.92 (0.85, 0.98)	0.98 (0.93, 1.04)	0.97 (0.89, 1.05)	1.02 (0.92, 1.12)	0.68	1.02 (0.99, 1.06)
Cancer Mortality	1.0	0.95 (0.90, 1.01)	0.91 (0.86, 0.95)	0.94 (0.88, 1.00)	0.93 (0.86, 1.00)	0.03	0.98 (0.96, 1.00)
<b>8-year lagged analysis</b>							
All-cause Mortality	1.0	0.96 (0.93, 0.99)	0.94 (0.91, 0.97)	0.93 (0.88, 0.97)	1.04 (0.98, 1.09)	0.49	1.02 (1.00, 1.03)
CVD Mortality	1.0	0.96 (0.89, 1.05)	0.90 (0.84, 0.97)	0.90 (0.80, 1.00)	1.10 (0.98, 1.24)	0.25	1.04 (1.00, 1.08)
Cancer Mortality	1.0	0.96 (0.90, 1.02)	0.93 (0.88, 0.98)	0.91 (0.84, 0.98)	1.01 (0.93, 1.10)	0.83	1.01 (0.99, 1.04)
<b>Adjusting for AHEI instead of foods</b>							
All-cause Mortality	1.0	0.96 (0.93, 0.98)	0.97 (0.94, 1.00)	0.98 (0.94, 1.02)	1.07 (1.02, 1.12)	0.02	1.02 (1.01, 1.04)
CVD Mortality	1.0	0.93 (0.87, 1.00)	0.95 (0.89, 1.00)	1.02 (0.93, 1.11)	1.12 (1.02, 1.24)	0.03	1.04 (1.01, 1.07)
Cancer Mortality	1.0	1.01 (0.96, 1.06)	0.99 (0.94, 1.03)	1.00 (0.93, 1.06)	1.03 (0.96, 1.12)	0.64	1.00 (0.98, 1.03)

Adjusted for: age, smoking, alcohol intake, postmenopausal hormone use (NHS), physical activity, family history of diabetes, family history of mi, family history of cancer, multivitamin use, ethnicity, aspirin use, baseline history of hypertension and hypercholesterolemia, intakes of whole grains, fruit, vegetables, red and processed meat, total energy and BMI. ASB and SSB were mutually adjusted. AHEI, alternative healthy eating index.

**Supplemental Table 4:** Total and Cause-specific Mortality According to Intake of Sugar- Sweetened Beverages (SSB) and Artificially Sweetened Beverages (ASB) based on data of the Nurses' Health Study (NHS) and Health Professionals Follow-up study (HPFS) using four categories of intake.

	≤1/w	2-6/wk	1 to <2/d	≥ 2/d	P trend	HR (95% CI) per 1 serving per day increment
<b>SSB</b>						
<b>NHS</b>						
Total mortality	1.0	1.03 (1.00, 1.07)	1.13 (1.07, 1.19)	1.24 (1.15, 1.33)	<0.0001	1.08 (1.05, 1.10)
CVD mortality	1.0	1.08 (0.99, 1.17)	1.19 (1.05, 1.35)	1.35 (1.14, 1.59)	<0.0001	1.11 (1.06, 1.16)
Cancer mortality	1.0	1.00 (0.95, 1.06)	1.06 (0.96, 1.16)	1.13 (1.00, 1.28)	0.02	1.03 (1.00, 1.07)
<b>HPFS</b>						
Total mortality	1.0	1.07 (1.03, 1.12)	1.16 (1.08, 1.25)	1.15 (1.02, 1.29)	<.0001	1.07 (1.03, 1.10)
CVD mortality	1.0	1.07 (0.99, 1.15)	1.15 (1.00, 1.33)	1.18 (0.94, 1.47)	0.02	1.07 (1.01, 1.14)
Cancer mortality	1.0	1.12 (1.04, 1.20)	1.21 (1.06, 1.38)	1.17 (0.95, 1.43)	0.003	1.08 (1.03, 1.15)
<b>Pooled</b>						
Total mortality	1.0	1.05 (1.03, 1.08)	1.14 (1.09, 1.19)	1.21 (1.14, 1.28)	<0.0001	1.07 (1.05, 1.09)
CVD mortality	1.0	1.08 (1.02, 1.14)	1.17 (1.07, 1.29)	1.29 (1.13, 1.47)	<0.0001	1.10 (1.06, 1.14)
Cancer mortality	1.0	1.05 (1.00, 1.10)	1.10 (1.02, 1.19)	1.14 (1.03, 1.27)	0.0005	1.05 (1.02, 1.08)
<b>ASB</b>						
<b>NHS</b>						
Total mortality	1.0	0.95 (0.92, 0.99)	0.98 (0.93, 1.03)	1.10 (1.04, 1.17)	0.01	1.03 (1.01, 1.05)
CVD mortality	1.0	0.92 (0.84, 1.00)	0.96 (0.86, 1.08)	1.17 (1.03, 1.32)	0.07	1.04 (1.00, 1.08)
Cancer mortality	1.0	0.95 (0.89, 1.00)	0.97 (0.90, 1.05)	1.04 (0.95, 1.14)	0.53	1.01 (0.98, 1.04)
<b>HPFS</b>						
Total mortality	1.0	1.01 (0.97, 1.05)	1.00 (0.93, 1.07)	1.00 (0.92, 1.09)	0.91	1.01 (0.98, 1.03)
CVD mortality	1.0	0.99 (0.92, 1.08)	1.11 (0.98, 1.26)	1.06 (0.91, 1.23)	0.29	1.03 (0.98, 1.07)
Cancer mortality	1.0	1.03 (0.95, 1.11)	0.99 (0.88, 1.13)	0.96 (0.82, 1.11)	0.51	0.99 (0.95, 1.03)
<b>Pooled</b>						

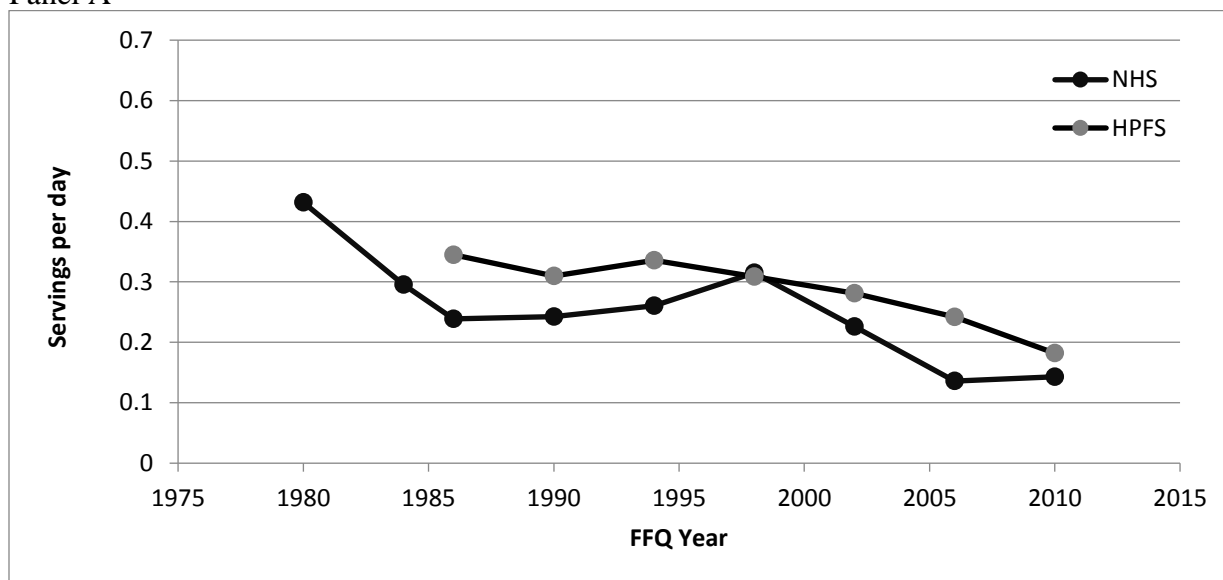
Total mortality	1.0	0.98 (0.96, 1.01)	0.99 (0.95, 1.03)	1.08 (1.03, 1.13)	0.01	1.03 (1.01, 1.04)
CVD mortality	1.0	0.96 (0.91, 1.02)	1.03 (0.95, 1.13)	1.14 (1.03, 1.26)	0.02	1.04 (1.01, 1.07)
Cancer mortality	1.0	0.99 (0.94, 1.03)	0.99 (0.93, 1.06)	1.03 (0.96, 1.11)	0.60	1.01 (0.98, 1.03)

Adjusted for: age, smoking, alcohol intake, postmenopausal hormone use (NHS), physical activity, family history of diabetes, family history of mi, family history of cancer, multivitamin use, ethnicity, aspirin use, baseline history of hypertension and hypercholesterolemia, intakes of whole grains, fruit, vegetables, red and processed meat, total energy and BMI. ASB and SSB were mutually adjusted.



**Supplemental Figure 1:** Mean intake of SSB (panel A-solid lines)) and ASB (panel B-dashed lines) in the Nurses' Health Study (NHS) and Health Professionals Follow-up Study (HPFS) by Food Frequency Questionnaire (FFQ)

Panel A



Panel B

