|  |  |  |  |  |  |  |  |
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| **Supplementary table 1 HRs and 95%CI for the association of total-carotenoids, alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein/zeaxanthin** | | | | | | | |
| **and Lycopene with all-cause and disease-specific mortalities in age more than 45 years old.** | | | | | | | |
| **Subgroup** | **Cases/N** | **Model 1** | | **Model 2** | | **Model 3** | |
| **HR (95%CI)** | **P** | **HR (95%CI)** | **P** | **HR (95%CI)** | **P** |
| **Respiratory disease** |  |  |  |  |  |  |  |
| **mortality** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 104/1472 | Ref | <0.001 | Ref | 0.004 | Ref | 0.005 |
| Q2 | 72/1452 | 0.62(0.46,0.84) |  | 0.72(0.50,1.02) |  | 0.73(0.51,1.04) |  |
| Q3 | 52/1430 | 0.44(0.31,0.62) |  | 0.53(0.34,0.81) |  | 0.54(0.35,0.83) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 85/1369 | Ref | <0.001 | Ref | 0.026 | Ref | 0.029 |
| Q2 | 81/1427 | 0.69(0.50,0.94) |  | 0.76(0.52,1.11) |  | 0.76(0.52,1.11) |  |
| Q3 | 62/1558 | 0.48(0.34,0.69) |  | 0.60(0.38,0.94) |  | 0.60(0.38,0.95) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 66/1147 | Ref | <0.001 | Ref | 0.091 | Ref | 0.104 |
| Q2 | 78/1421 | 0.72(0.53,0.98) |  | 0.71(0.49,1.04) |  | 0.72(0.5,1.05) |  |
| Q3 | 84/1786 | 0.56(0.40,0.78) |  | 0.70(0.46,1.06) |  | 0.71(0.47,1.07) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 118/1909 | Ref | 0.001 | Ref | 0.099 | Ref | 0.104 |
| Q2 | 63/1090 | 0.88(0.65,1.20) |  | 1.06(0.74,1.52) |  | 1.05(0.73,1.51) |  |
| Q3 | 47/1355 | 0.56(0.39,0.79) |  | 0.69(0.44,1.07) |  | 0.69(0.45,1.08) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 100/1295 | Ref | <0.001 | Ref | 0.002 | Ref | 0.002 |
| Q2 | 72/1398 | 0.54(0.39,0.74) |  | 0.63(0.43,0.90) |  | 0.64(0.44,0.92) |  |
| Q3 | 56/1661 | 0.45(0.32,0.63) |  | 0.52(0.34,0.78) |  | 0.53(0.35,0.79) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 123/1983 | Ref | <0.001 | Ref | 0.072 | Ref | 0.071 |
| Q2 | 64/1342 | 0.77(0.56,1.04) |  | 0.92(0.64,1.32) |  | 0.90(0.63,1.30) |  |
| Q3 | 41/1029 | 0.55(0.39,0.79) |  | 0.68(0.45,1.03) |  | 0.68(0.45,1.03) |  |
|  |  |  |  |  |  |  |  |
| All-cause |  |  |  |  |  |  |  |
| **mortality** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 1234/1472 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 1096/1452 | 0.79(0.72,0.86) |  | 0.81(0.74,0.90) |  | 0.82(0.74,0.90) |  |
| Q3 | 1033/1430 | 0.71(0.65,0.77) |  | 0.77(0.69,0.85) |  | 0.76(0.68,0.84) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 1121/1369 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 1105/1427 | 0.85(0.78,0.92) |  | 0.93(0.84,1.02) |  | 0.90(0.82,0.99) |  |
| Q3 | 1134/1558 | 0.72(0.66,0.79) |  | 0.79(0.71,0.88) |  | 0.75(0.68,0.84) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 905/1147 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 1080/1421 | 0.80(0.73,0.87) |  | 0.84(0.76,0.93) |  | 0.86(0.78,0.95) |  |
| Q3 | 1375/1786 | 0.74(0.68,0.81) |  | 0.80(0.72,0.89) |  | 0.81(0.73,0.90) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 1570/1909 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 824/1090 | 0.86(0.79,0.94) |  | 0.86(0.79,0.94) |  | 0.84(0.76,0.92) |  |
| Q3 | 966/1355 | 0.78(0.72,0.85) |  | 0.75(0.69,0.81) |  | 0.81(0.73,0.90) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 1069/1295 | Ref | <0.001 | Ref | 0.002 | Ref | <0.001 |
| Q2 | 1055/1398 | 0.84(0.78,0.92) |  | 0.89(0.81,0.98) |  | 0.89(0.81,0.98) |  |
| Q3 | 1236/1661 | 0.76(0.70,0.83) |  | 0.85(0.77,0.94) |  | 0.83(0.75,0.92) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 1676/1983 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 1005/1342 | 0.88(0.81,0.95) |  | 0.90(0.82,0.99) |  | 0.89(0.81,0.98) |  |
| Q3 | 679/1029 | 0.77(0.70,0.84) |  | 0.81(0.73,0.90) |  | 0.80(0.72,0.89) |  |
| **Data are HRs and 95%CI;** | | | | | | | |
| **Model 1 was adjusted for age, sex, race, marriage and education;** | | | | | | | |
| **Model 2 was model 1 with additional adjustments for sport, drink, smoke, bmi, income, energy,** | | | | | | | |
| **vitamin E, vitamin C, fruit intake and vegetable intake.** | | | | | | | |
| **Model 3 was model 2 with additional adjustments for diabetes, hypertension, asthma, emphysema and chronic bronchitis.** | | | | | | | |

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| **Supplementary table 2 HRs and 95%CI for the association of total-carotenoids, alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein/zeaxanthin** | | | | | | | |
| **and Lycopene with all-cause and disease-specific mortalities in populations excluding limit values.** | | | | | | | |
| **Subgroup** | **Cases/N** | **Model 1** | | **Model 2** | | **Model 3** | |
| **HR (95%CI)** | **P** | **HR (95%CI)** | **P** | **HR (95%CI)** | **P** |
| **Respiratory disease** |  |  |  |  |  |  |  |
| **mortality** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 104/2515 | Ref | <0.001 | Ref | 0.002 | Ref | 0.003 |
| Q2 | 72/2486 | 0.67(0.49,0.91) |  | 0.82(0.58,1.16) |  | 0.83(0.59,1.17) |  |
| Q3 | 62/2445 | 0.47(0.34,0.64) |  | 0.54(0.36,0.80) |  | 0.55(0.37,0.82) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 101/3084 | Ref | <0.001 | Ref | 0.001 | Ref | 0.001 |
| Q2 | 83/2346 | 0.77(0.57,1.03) |  | 0.74(0.53,1.05) |  | 0.74(0.53,1.05) |  |
| Q3 | 54/2016 | 0.46(0.32,0.65) |  | 0.48(0.31,0.74) |  | 0.48(0.31,0.75) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 80/2712 | Ref | <0.001 | Ref | 0.024 | Ref | 0.026 |
| Q2 | 78/2393 | 0.79(0.57,1.09) |  | 0.83(0.57,1.20) |  | 0.83(0.57,1.20) |  |
| Q3 | 80/2341 | 0.58(0.42,0.81) |  | 0.63(0.42,0.94) |  | 0.63(0.42,0.95) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 99/2499 | Ref | 0.003 | Ref | 0.100 | Ref | 0.101 |
| Q2 | 85/2577 | 0.92(0.68,1.23) |  | 1.09(0.78,1.53) |  | 1.09(0.78,1.53) |  |
| Q3 | 54/2370 | 0.60(0.42,0.84) |  | 0.70(0.46,1.07) |  | 0.70(0.46,1.07) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 111/2674 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 76/2510 | 0.64(0.48,0.86) |  | 0.76(0.54,1.07) |  | 0.77(0.55,1.08) |  |
| Q3 | 51/2262 | 0.40(0.29,0.57) |  | 0.46(0.31,0.70) |  | 0.47(0.31,0.71) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 125/2672 | Ref | 0.003 | Ref | 0.026 | Ref | 0.027 |
| Q2 | 59/2305 | 0.62(0.45,0.85) |  | 0.64(0.45,0.92) |  | 0.64(0.44,0.92) |  |
| Q3 | 54/2469 | 0.60(0.43,0.84) |  | 0.65(0.44,0.95) |  | 0.65(0.44,0.95) |  |
|  |  |  |  |  |  |  |  |
| **A**ll-cause |  |  |  |  |  |  |  |
| **mortality** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 1405/2515 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 1114/2486 | 0.74(0.68,0.80) |  | 0.76(0.69,0.83) |  | 0.76(0.69,0.83) |  |
| Q3 | 1207/2445 | 0.66(0.61,0.71) |  | 0.73(0.66,0.80) |  | 0.73(0.66,0.80) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 1488/3084 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 1189/2346 | 0.81(0.75,0.88) |  | 0.84(0.76,0.91) |  | 0.84(0.77,0.92) |  |
| Q3 | 1049/2016 | 0.69(0.63,0.75) |  | 0.76(0.69,0.84) |  | 0.75(0.68,0.84) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 1224/2712 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 1145/2393 | 0.78(0.72,0.85) |  | 0.81(0.74,0.89) |  | 0.84(0.76,0.92) |  |
| Q3 | 1357/2341 | 0.72(0.66,0.78) |  | 0.78(0.71,0.87) |  | 0.80(0.72,0.88) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 1444/2499 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 1200/2577 | 0.84(0.77,0.90) |  | 0.86(0.78,0.94) |  | 0.86(0.78,0.94) |  |
| Q3 | 1082/2370 | 0.72(0.66,0.78) |  | 0.78(0.7,0.86) |  | 0.78(0.71,0.86) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 1317/2674 | Ref | <0.001 | Ref | 0.002 | Ref | <0.001 |
| Q2 | 1182/2510 | 0.79(0.73,0.86) |  | 0.84(0.77,0.93) |  | 0.85(0.77,0.93) |  |
| Q3 | 1227/2262 | 0.75(0.69,0.81) |  | 0.84(0.77,0.92) |  | 0.84(0.77,0.93) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 1780/2672 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 1074/2305 | 0.81(0.75,0.88) |  | 0.84(0.77,0.92) |  | 0.85(0.77,0.92) |  |
| Q3 | 872/2469 | 0.71(0.65,0.77) |  | 0.76(0.69,0.84) |  | 0.76(0.69,0.84) |  |
| **Data are HRs and 95%CI;** | | | | | | | |
| **Model 1 was adjusted for age, sex, race, marriage and education;** | | | | | | | |
| **Model 2 was model 1 with additional adjustments for sport, drink, smoke, bmi, income, energy,** | | | | | | | |
| **vitamin E, vitamin C, fruit intake and vegetable intake.** | | | | | | | |
| **Model 3 was model 2 with additional adjustments for diabetes, hypertension, asthma, emphysema and chronic bronchitis.** | | | | | | | |

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| **Supplementary table 3 HRs and 95%CI for the association of total-carotenoids, alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein/zeaxanthin** | | | | | | | |
| **and Lycopene with all-cause and disease-specific mortalities among those excluded from follow-up of less than two years.** | | | | | | | |
| **Subgroup** | **Cases/N** | **Model 1** | | **Model 2** | | **Model 3** | |
| **HR (95%CI)** | **P** | **HR (95%CI)** | **P** | **HR (95%CI)** | **P** |
| **Respiratory disease** |  |  |  |  |  |  |  |
| **mortality** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 104/2617 | Ref | <0.001 | Ref | 0.022 | Ref | 0.049 |
| Q2 | 67/2566 | 0.63(0.46,0.85) |  | 0.73(0.51,1.05) |  | 0.74(0.52,1.05) |  |
| Q3 | 59/2429 | 0.46(0.33,0.64) |  | 0.62(0.41,0.93) |  | 0.63(0.42,0.94) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 95/3001 | Ref | <0.001 | Ref | 0.004 | Ref | 0.029 |
| Q2 | 80/2337 | 0.79(0.58,1.07) |  | 0.76(0.54,1.08) |  | 0.76(0.53,1.08) |  |
| Q3 | 55/2274 | 0.44(0.31,0.63) |  | 0.52(0.34,0.81) |  | 0.52(0.34,0.81) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 79/2650 | Ref | <0.001 | Ref | 0.049 | Ref | 0.048 |
| Q2 | 74/2557 | 0.68(0.49,0.94) |  | 0.73(0.5,1.07) |  | 0.72(0.50,1.06) |  |
| Q3 | 77/2405 | 0.53(0.38,0.74) |  | 0.66(0.44,1.00) |  | 0.66(0.44,1.00) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 122/3283 | Ref | 0.001 | Ref | 0.087 | Ref | 0.089 |
| Q2 | 66/2060 | 0.87(0.64,1.18) |  | 1.04(0.74,1.48) |  | 1.06(0.75,1.49) |  |
| Q3 | 42/2269 | 0.51(0.35,0.73) |  | 0.68(0.43,1.06) |  | 0.68(0.43,1.06) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 103/2602 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 77/2521 | 0.67(0.50,0.91) |  | 0.81(0.57,1.14) |  | 0.82(0.58,1.15) |  |
| Q3 | 50/2489 | 0.37(0.26,0.52) |  | 0.44(0.29,0.66) |  | 0.44(0.29,0.67) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 114/2598 | Ref | 0.008 | Ref | 0.122 | Ref | 0.123 |
| Q2 | 62/2598 | 0.63(0.46,0.86) |  | 0.69(0.48,0.99) |  | 0.69(0.48,0.98) |  |
| Q3 | 54/2416 | 0.63(0.45,0.89) |  | 0.74(0.50,1.08) |  | 0.74(0.50,1.08) |  |
|  |  |  |  |  |  |  |  |
| A**ll-cause** |  |  |  |  |  |  |  |
| **mortality** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 1385/2617 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 1117/2566 | 0.77(0.71,0.84) |  | 0.79(0.72,0.87) |  | 0.80(0.73,0.88) |  |
| Q3 | 1189/2429 | 0.69(0.64,0.75) |  | 0.76(0.69,0.84) |  | 0.76(0.69,0.84) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 1338/3001 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 1148/2337 | 0.83(0.76,0.90) |  | 0.85(0.78,0.93) |  | 0.86(0.78,0.94) |  |
| Q3 | 1155/2274 | 0.71(0.66,0.78) |  | 0.80(0.73,0.89) |  | 0.80(0.72,0.88) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 1149/2650 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 1168/2557 | 0.79(0.72,0.85) |  | 0.80(0.73,0.88) |  | 0.83(0.75,0.91) |  |
| Q3 | 1374/2405 | 0.73(0.67,0.79) |  | 0.81(0.73,0.89) |  | 0.82(0.75,0.91) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 1744/3283 | Ref | <0.001 | Ref | 0.001 | Ref | <0.001 |
| Q2 | 922/2060 | 0.83(0.77,0.90) |  | 0.86(0.78,0.94) |  | 0.85(0.77,0.93) |  |
| Q3 | 1025/2269 | 0.77(0.71,0.84) |  | 0.85(0.77,0.94) |  | 0.84(0.76,0.93) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 1230/2602 | Ref | <0.001 | Ref | 0.002 | Ref | <0.001 |
| Q2 | 1154/2521 | 0.81(0.75,0.88) |  | 0.85(0.78,0.94) |  | 0.85(0.78,0.94) |  |
| Q3 | 1307/2489 | 0.75(0.70,0.82) |  | 0.83(0.76,0.92) |  | 0.84(0.76,0.92) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 1674/2598 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 1169/2598 | 0.83(0.77,0.90) |  | 0.85(0.78,0.93) |  | 0.85(0.78,0.93) |  |
| Q3 | 848/2416 | 0.73(0.67,0.79) |  | 0.78(0.70,0.86) |  | 0.78(0.70,0.86) |  |
| **Data are HRs and 95%CI;** | | | | | | | |
| **Model 1 was adjusted for age, sex, race, marriage and education;** | | | | | | | |
| **Model 2 was model 1 with additional adjustments for sport, drink, smoke,, , bmi, income, energy,** | | | | | | | |
| **vitamin E, vitamin C, fruit intake and vegetable intake.** | | | | | | | |
| **Model 3 was model 2 with additional adjustments for diabetes, hypertension, asthma, emphysema and chronic bronchitis.** | | | | | | | |

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| **Supplementary table 4 HRs and 95%CI for the association of total-carotenoids, alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein/zeaxanthin and Lycopene with the prevalence of asthma, emphysema and chronic bronchitis grouped by BMI (BMI < 25 kg/m², BMI ≥ 25 kg/m² ).** | | | | | | | | | | | | | | |
| **Subgroup** | **Cases/N** | **BMI < 25 kg/m² (n = 3159)** | | | | | | **Cases/N** | **BMI ≥ 25 kg/m² (n = 4725)** | | | | | |
| **Model 1** | | **Model 2** | | **Model 3** | | **Model 1** | | **Model 2** | | **Model 3** | |
| **HR (95%CI)** | **P** | **HR (95%CI)** | **P** | **HR (95%CI)** | **P** | **HR (95%CI)** | **P** | **HR (95%CI)** | **P** | **HR (95%CI)** | **P** |
| **Respiratory disease** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **mortality** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 55/1068 | Ref | <0.001 | Ref | 0.004 | Ref | 0.003 | 56/1583 | Ref | 0.007 | Ref | 0.409 | Ref | 0.444 |
| Q2 | 30/1056 | 0.49(0.31,0.77) |  | 0.41(0.23,0.71) |  | 0.40(0.23,0.70) |  | 42/1614 | 0.73(0.48,1.09) |  | 0.9(0.58,1.41) |  | 0.91(0.58,1.42) |  |
| Q3 | 34/1035 | 0.47(0.30,0.73) |  | 0.42(0.23,0.76) |  | 0.41(0.22,0.74) |  | 36/1546 | 0.54(0.35,0.84) |  | 0.8(0.48,1.35) |  | 0.82(0.49,1.37) |  |
| α-carotene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 50/1245 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 | 52/1875 | Ref | 0.020 | Ref | 0.498 | Ref | 0.516 |
| Q2 | 41/915 | 0.82(0.53,1.26) |  | 0.73(0.43,1.23) |  | 0.70(0.41,1.18) |  | 47/1514 | 0.85(0.56,1.28) |  | 0.98(0.62,1.57) |  | 0.99(0.62,1.59) |  |
| Q3 | 28/999 | 0.40(0.24,0.66) |  | 0.31(0.16,0.60) |  | 0.29(0.15,0.57) |  | 35/1354 | 0.58(0.37,0.92) |  | 0.83(0.48,1.43) |  | 0.83(0.48,1.45) |  |
| β-carotene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 46/1185 | Ref | 0.003 | Ref | 0.005 | Ref | 0.005 | 40/1699 | Ref | 0.115751 | Ref | 0.947 | Ref | 0.926 |
| Q2 | 35/953 | 0.71(0.45,1.13) |  | 0.51(0.29,0.90) |  | 0.51(0.29,0.90) |  | 46/1515 | 0.92(0.59,1.42) |  | 1.03(0.63,1.68) |  | 1.03(0.63,1.68) |  |
| Q3 | 38/1021 | 0.50(0.31,0.79) |  | 0.42(0.22,0.77) |  | 0.41(0.22,0.76) |  | 48/1529 | 0.70(0.44,1.09) |  | 1.02(0.59,1.75) |  | 1.03(0.60,1.76) |  |
| β-cryptoxanthin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 61/1419 | Ref | 0.049 | Ref | 0.118 | Ref | 0.096 | 70/2019 | Ref | 0.01624 | Ref | 0.704 | Ref | 0.76866 |
| Q2 | 28/699 | 0.84(0.53,1.33) |  | 0.76(0.42,1.35) |  | 0.74(0.41,1.32) |  | 39/1209 | 1.01(0.68,1.51) |  | 1.41(0.90,2.20) |  | 1.43(0.91,2.24) |  |
| Q3 | 30/1041 | 0.63(0.40,1.00) |  | 0.63(0.35,1.13) |  | 0.60(0.33,1.09) |  | 25/1434 | 0.56(0.35,0.90) |  | 0.90(0.51,1.58) |  | 0.92(0.52,1.63) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 56/1138 | Ref | <0.001 | Ref | 0.018 | Ref | 0.012 | 70/1815 | Ref | <0.001 | Ref | 0.003 | Ref | 0.003 |
| Q2 | 35/1035 | 0.59(0.38,0.91) |  | 0.78(0.46,1.3) |  | 0.76(0.45,1.28) |  | 35/1470 | 0.53(0.35,0.81) |  | 0.58(0.36,0.92) |  | 0.58(0.36,0.93) |  |
| Q3 | 29/986 | 0.43(0.27,0.69) |  | 0.48(0.27,0.88) |  | 0.46(0.25,0.84) |  | 29/1458 | 0.39(0.25,0.61) |  | 0.45(0.27,0.76) |  | 0.46(0.27,0.77) |  |
| Lycopene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 63/1115 | Ref | 0.030 | Ref | 0.064 | Ref | 0.066 | 66/1669 | Ref | 0.042 | Ref | 0.045 | Ref | 0.048 |
| Q2 | 31/1071 | 0.56(0.36,0.88) |  | 0.65(0.38,1.12) |  | 0.65(0.38,1.12) |  | 39/1596 | 0.75(0.50,1.12) |  | 0.73(0.47,1.14) |  | 0.73(0.47,1.15) |  |
| Q3 | 25/973 | 0.58(0.35,0.95) |  | 0.59(0.34,1.03) |  | 0.59(0.34,1.04) |  | 29/1478 | 0.62(0.39,0.98) |  | 0.59(0.35,0.99) |  | 0.59(0.35,1.00) |  |
| **All-cause** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **mortality** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 558/1068 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 | 910/1583 | Ref | 0.007 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 436/1056 | 0.73(0.64,0.82) |  | 0.74(0.63,0.86) |  | 0.73(0.63,0.85) |  | 769/1614 | 0.76(0.69,0.84) |  | 0.78(0.7,0.88) |  | 0.80(0.71,0.89) |  |
| Q3 | 481/1035 | 0.63(0.55,0.71) |  | 0.66(0.56,0.78) |  | 0.66(0.56,0.77) |  | 824/1546 | 0.72(0.65,0.79) |  | 0.8(0.71,0.9) |  | 0.79(0.70,0.89) |  |
| α-carotene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 586/1245 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 | 920/1875 | Ref | <0.001 | Ref | 0.016 | Ref | 0.007 |
| Q2 | 409/915 | 0.79(0.69,0.90) |  | 0.82(0.71,0.96) |  | 0.82(0.70,0.95) |  | 829/1514 | 0.86(0.78,0.95) |  | 0.91(0.81,1.02) |  | 0.92(0.82,1.03) |  |
| Q3 | 480/999 | 0.65(0.57,0.74) |  | 0.63(0.53,0.75) |  | 0.63(0.53,0.75) |  | 754/1354 | 0.73(0.66,0.81) |  | 0.86(0.76,0.97) |  | 0.84(0.74,0.95) |  |
| β-carotene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 526/1185 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 | 770/1699 | Ref | <0.001 | Ref | 0.014 | Ref | 0.061 |
| Q2 | 381/953 | 0.75(0.65,0.85) |  | 0.76(0.65,0.89) |  | 0.76(0.65,0.90) |  | 791/1515 | 0.81(0.73,0.9) |  | 0.83(0.74,0.94) |  | 0.86(0.77,0.97) |  |
| Q3 | 568/1021 | 0.69(0.60,0.78) |  | 0.76(0.64,0.89) |  | 0.76(0.64,0.89) |  | 942/1529 | 0.77(0.7,0.86) |  | 0.86(0.76,0.97) |  | 0.89(0.79,1.01) |  |
| β-cryptoxanthin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 733/1419 | Ref | <0.001 | Ref | 0.002 | Ref | 0.002 | 1163/2019 | Ref | <0.001 | Ref | 0.030 | Ref | 0.008 |
| Q2 | 290/699 | 0.78(0.68,0.90) |  | 0.79(0.67,0.93) |  | 0.78(0.66,0.92) |  | 640/1290 | 0.88(0.80,0.97) |  | 0.90(0.81,1.01) |  | 0.88(0.79,0.99) |  |
| Q3 | 452/1041 | 0.74(0.65,0.84) |  | 0.78(0.67,0.91) |  | 0.77(0.66,0.91) |  | 700/1434 | 0.78(0.71,0.86) |  | 0.87(0.77,0.99) |  | 0.85(0.75,0.96) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 510/1138 | Ref | <0.001 | Ref | 0.066 | Ref | 0.029 | 947/1815 | Ref | <0.001 | Ref | 0.007 | Ref | 0.006 |
| Q2 | 467/1035 | 0.81(0.72,0.90) |  | 0.89(0.76,1.03) |  | 0.88(0.76,1.03) |  | 725/1470 | 0.8(0.72,0.88) |  | 0.84(0.75,0.94) |  | 0.85(0.76,0.95) |  |
| Q3 | 498/986 | 0.74(0.67,0.83) |  | 0.86(0.74,1.01) |  | 0.84(0.71,0.98) |  | 831/1458 | 0.77(0.7,0.85) |  | 0.85(0.76,0.96) |  | 0.85(0.76,0.95) |  |
| Lycopene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 725/1115 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 | 1133/1669 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 448/1071 | 0.75(0.67,0.85) |  | 0.77(0.66,0.89) |  | 0.77(0.67,0.89) |  | 789/1596 | 0.85(0.78,0.94) |  | 0.89(0.80,0.99) |  | 0.90(0.81,1.01) |  |
| Q3 | 302/873 | 0.63(0.55,0.73) |  | 0.64(0.54,0.75) |  | 0.63(0.54,0.74) |  | 581/1478 | 0.75(0.68,0.83) |  | 0.80(0.71,0.90) |  | 0.81(0.72,0.91) |  |
| **Data are HRs and 95%CI;** | | | | | | | |  |  |  |  |  |  |  |
| **Model 1 was adjusted for age, sex, race, marriage and education;** | | | | | | | |  |  |  |  |  |  |  |
| **Model 2 was model 1 with additional adjustments for sport, drink, smoke, bmi, income, energy,** | | | | | | | | | | | | | | |
| **vitamin E, vitamin C, fruit intake and vegetable intake.** | | | | | | | |  |  |  |  |  |  |  |
| **Model 3 was model 2 with additional adjustments for diabetes, hypertension, asthma, emphysema and chronic bronchitis.** | | | | | | | | | | | | | | |

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| **Supplementary table 5 HRs and 95%CI for the association of alpha-carotene, beta-carotenoids, beta-cryptoxanthin, lutein/zeaxanthin and Lycopene** | | | | | | | | | | | | | | |
| **with all-cause and disease-specific mortalities group by smoking or not.** | | | | | | | |  |  |  |  |  |  |  |
| **Subgroup** | **Cases/N** | **Never⁄ Former smokers (n=3913)** | | | | | | **Cases/N** | **Current smokers (n=3971)** | | | | | |
| **Model 1** | | **Model 2** | | **Model 3** | | **Model 1** | | **Model 2** | | **Model 3** | |
| **HR (95%CI)** | **P** | **HR (95%CI)** | **P** | **HR (95%CI)** | **P** | **HR (95%CI)** | **P** | **HR (95%CI)** | **P** | **HR (95%CI)** | **P** |
| **Respiratory disease** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **mortality** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 58/1307 | Ref | 0.008 | Ref | 0.022 | Ref | 0.023 | 56/1348 | Ref | 0.011 | Ref | 0.046 | Ref | 0.055 |
| Q2 | 43/1336 | 0.71(0.47,1.06) |  | 0.64(0.40,1.05) |  | 0.65(0.40,1.06) |  | 27/1304 | 0.57(0.36,0.91) |  | 0.51(0.30,0.87) |  | 0.53(0.31,0.90) |  |
| Q3 | 41/1270 | 0.57(0.38,0.87) |  | 0.54(0.32,0.91) |  | 0.54(0.32,0.92) |  | 28/1319 | 0.55(0.34,0.87) |  | 0.57(0.33,0.99) |  | 0.58(0.34,1.01) |  |
| α-carotene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 52/1532 | Ref | 0.004 | Ref | 0.001 | Ref | 0.001 | 50/1657 | Ref | 0.1651 | Ref | 0.450892 | Ref | 0.525 |
| Q2 | 45/1136 | 0.76(0.50,1.15) |  | 0.73(0.45,1.18) |  | 0.74(0.46,1.19) |  | 32/1177 | 0.79(0.50,1.24) |  | 0.8(0.48,1.36) |  | 0.83(0.49,1.40) |  |
| Q3 | 45/1245 | 0.53(0.35,0.82) |  | 0.4(0.23,0.700) |  | 0.41(0.23,0.70) |  | 29/1137 | 0.71(0.44,1.15) |  | 0.8(0.45,1.42) |  | 0.83(0.47,1.48) |  |
| β-carotene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 44/1503 | Ref | 0.124 | Ref | 0.147 | Ref | 0.155 | 40/1433 | Ref | 0.263 | Ref | 0.555 | Ref | 0.625 |
| Q2 | 39/1154 | 0.81(0.52,1.27) |  | 0.68(0.40,1.17) |  | 0.69(0.40,1.17) |  | 35/1245 | 0.84(0.53,1.34) |  | 0.78(0.46,1.32) |  | 0.81(0.48,1.37) |  |
| Q3 | 59/1256 | 0.72(0.47,1.10) |  | 0.67(0.39,1.15) |  | 0.67(0.39,1.16) |  | 36/1293 | 0.77(0.48,1.22) |  | 0.85(0.49,1.46) |  | 0.87(0.50,1.51) |  |
| β-cryptoxanthin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 65/1530 | Ref | 0.077 | Ref | 0.207 | Ref | 0.218 | 48/1402 | Ref | 0.232 | Ref | 0.874 | Ref | 0.979 |
| Q2 | 41/1153 | 0.99(0.66,1.47) |  | 0.98(0.61,1.56) |  | 0.98(0.62,1.57) |  | 39/1313 | 1.05(0.68,1.62) |  | 1.24(0.76,2.03) |  | 1.28(0.78,2.10) |  |
| Q3 | 36/1230 | 0.68(0.44,1.04) |  | 0.70(0.41,1.21) |  | 0.71(0.41,1.23) |  | 24/1256 | 0.73(0.44,1.22) |  | 0.95(0.51,1.77) |  | 0.99(0.53,1.85) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 61/1393 | Ref | <0.001 | Ref | 0.001 | Ref | 0.001 | 57/1489 | Ref | 0.009 | Ref | 0.015 | Ref | 0.018 |
| Q2 | 49/1350 | 0.77(0.53,1.13) |  | 0.71(0.45,1.12) |  | 0.71(0.45,1.12) |  | 28/1175 | 0.74(0.47,1.18) |  | 0.73(0.44,1.22) |  | 0.74(0.44,1.24) |  |
| Q3 | 32/1170 | 0.46(0.30,0.72) |  | 0.41(0.24,0.71) |  | 0.41(0.23,0.70) |  | 26/1307 | 0.53(0.33,0.85) |  | 0.49(0.28,0.87) |  | 0.51(0.29,0.89) |  |
| Lycopene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 68/1305 | Ref | 0.164 | Ref | 0.135 | Ref | 0.1336 | 61/1471 | Ref | 0.010 | Ref | 0.0461 | Ref | 0.053 |
| Q2 | 36/1343 | 0.62(0.41,0.94) |  | 0.57(0.35,0.93) |  | 0.57(0.35,0.93) |  | 31/1201 | 0.74(0.47,1.15) |  | 0.77(0.47,1.28) |  | 0.78(0.47,1.29) |  |
| Q3 | 38/1265 | 0.74(0.49,1.13) |  | 0.69(0.42,1.12) |  | 0.69(0.42,1.12) |  | 19/1299 | 0.49(0.29,0.84) |  | 0.55(0.31,0.99) |  | 0.56(0.31,1.01) |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **All-cause** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **mortality** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 632/1307 | Ref | <0.001 | Ref | <0.001 | Ref | 0.023 | 882/1348 | Ref | <0.001 | Ref | 0.006 | Ref | 0.012 |
| Q2 | 496/1336 | 0.77(0.68,0.86) |  | 0.77(0.67,0.89) |  | 0.79(0.68,0.90) |  | 715/1304 | 0.92(0.83,1.02) |  | 0.92(0.82,1.03) |  | 0.94(0.83,1.05) |  |
| Q3 | 508/1270 | 0.71(0.63,0.80) |  | 0.71(0.61,0.82) |  | 0.71(0.61,0.82) |  | 730/1319 | 0.79(0.72,0.88) |  | 0.84(0.75,0.95) |  | 0.85(0.76,0.97) |  |
| α-carotene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 661/1532 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 | 977/1657 | Ref | <0.001 | Ref | 0.009 | Ref | 0.003 |
| Q2 | 457/1136 | 0.73(0.64,0.82) |  | 0.72(0.63,0.83) |  | 0.73(0.64,0.84) |  | 699/1177 | 0.86(0.78,0.95) |  | 0.92(0.82,1.04) |  | 0.90(0.80,1.01) |  |
| Q3 | 518/1245 | 0.67(0.59,0.76) |  | 0.66(0.57,0.77) |  | 0.67(0.57,0.78) |  | 651/1137 | 0.79(0.71,0.87) |  | 0.85(0.74,0.96) |  | 0.83(0.73,0.94) |  |
| β-carotene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 592/1503 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 | 797/1433 | Ref | 0.005 | Ref | 0.0528 | Ref | 0.071 |
| Q2 | 442/1154 | 0.82(0.72,0.93) |  | 0.81(0.7,0.94) |  | 0.83(0.72,0.96) |  | 708/1245 | 0.87(0.79,0.96) |  | 0.9(0.8,1.01) |  | 0.9(0.8,1.02) |  |
| Q3 | 602/1256 | 0.74(0.65,0.84) |  | 0.76(0.65,0.88) |  | 0.77(0.67,0.90) |  | 822/1293 | 0.84(0.76,0.93) |  | 0.89(0.78,1) |  | 0.89(0.79,1.01) |  |
| β-cryptoxanthin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 747/1530 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 | 953/1402 | Ref | 0.0016 | Ref | 0.115 | Ref | 0.076 |
| Q2 | 425/1153 | 0.84(0.74,0.95) |  | 0.82(0.72,0.95) |  | 0.83(0.72,0.95) |  | 704/1313 | 0.87(0.79,0.96) |  | 0.90(0.80,1.01) |  | 0.9(0.8,1.01) |  |
| Q3 | 464/1230 | 0.74(0.66,0.84) |  | 0.75(0.65,0.87) |  | 0.74(0.64,0.86) |  | 670/1256 | 0.85(0.76,0.94) |  | 0.9(0.79,1.03) |  | 0.89(0.78,1.01) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 581/1393 | Ref | <0.001 | Ref | 0.009 | Ref | 0.007 | 893/1489 | Ref | <0.001 | Ref | 0.074 | Ref | 0.080 |
| Q2 | 507/1350 | 0.77(0.68,0.87) |  | 0.79(0.69,0.91) |  | 0.78(0.68,0.9) |  | 663/1175 | 0.93(0.84,1.03) |  | 0.99(0.88,1.11) |  | 1.01(0.89,1.14) |  |
| Q3 | 548/1170 | 0.80(0.70,0.90) |  | 0.82(0.71,0.95) |  | 0.82(0.7,0.95) |  | 771/1307 | 0.83(0.75,0.92) |  | 0.90(0.80,1.01) |  | 0.90(0.80,1.01) |  |
| Lycopene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 741/1305 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 | 1111/1471 | Ref | <0.001 | Ref | 0.001 | Ref | 0.002 |
| Q2 | 505/1343 | 0.80(0.71,0.90) |  | 0.77(0.67,0.88) |  | 0.76(0.67,0.87) |  | 673/1201 | 0.86(0.78,0.95) |  | 0.90(0.80,1.00) |  | 0.90(0.80,1.01) |  |
| Q3 | 390/1265 | 0.72(0.64,0.82) |  | 0.72(0.62,0.83) |  | 0.7(0.61,0.82) |  | 543/1299 | 0.77(0.69,0.86) |  | 0.81(0.72,0.92) |  | 0.82(0.72,0.93) |  |
| **Data are HRs and 95%CI;** | | | | | | | |  |  |  |  |  |  |  |
| Model 1 was adjusted for age, sex**；** | | | | | | | |  |  |  |  |  |  |  |
| **Model 2 was model 1 with additional adjustments for sport, drink, smoke , bmi, income, energy;** | | | | | | | | | | | | | | |
| **Model 3 was model 2 with additional adjustments for diabetes, hypertension, asthma, emphysema and chronic bronchitis.** | | | | | | | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Supplementary table 6 ORs and 95%CI for the association of total-carotenoids, alpha-carotene, beta-carotene, beta-cryptoxanthin,** | | | | | | | |
| **lutein/zeaxanthin and Lycopene with the prevalence of asthma, emphysema and chronic bronchitis in age more than 45 years old.** | | | | | | | |
| **Subgroup** | **Cases/N** | **Model 1** | | **Model 2** | | **Model 3** | |
| **OR (95%CI)** | **P** | **OR (95%CI)** | **P** | **OR (95%CI)** | **P** |
| **Asthma** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 113/1472 | Ref | 0.830 | Ref | 0.380 | Ref | 0.346 |
| Q2 | 109/1452 | 0.95(0.72,1.25) |  | 1.05(0.77,1.44) |  | 1.07(0.78,1.47) |  |
| Q3 | 117/1430 | 1.03(0.78,1.36) |  | 1.16(0.83,1.63) |  | 1.18(0.84,1.65) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 264/3116 | Ref | 0.382 | Ref | 0.316 | Ref | 0.337 |
| Q2 | 183/2422 | 1.08(0.83,1.41) |  | 1.11(0.82,1.50) |  | 1.11(0.82,1.51) |  |
| Q3 | 162/2346 | 0.88(0.65,1.18) |  | 0.83(0.58,1.19) |  | 0.84(0.58,1.20) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 203/2731 | Ref | 0.273 | Ref | 0.156 | Ref | 0.136 |
| Q2 | 199/2648 | 1.02(0.77,1.36) |  | 1.00(0.72,1.38) |  | 1.01(0.73,1.40) |  |
| Q3 | 207/2505 | 1.17(0.88,1.55) |  | 1.27(0.91,1.78) |  | 1.29(0.92,1.80) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 284/3429 | Ref | 0.993 | Ref | 0.414 | Ref | 0.401 |
| Q2 | 167/2124 | 1.06(0.80,1.40) |  | 1.10(0.80,1.50) |  | 1.10(0.80,1.50) |  |
| Q3 | 158/2331 | 1.00(0.75,1.32) |  | 1.15(0.82,1.61) |  | 1.16(0.83,1.62) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 243/2706 | Ref | 0.276 | Ref | 0.206 | Ref | 0.223 |
| Q2 | 181/2600 | 0.89(0.68,1.17) |  | 0.88(0.65,1.19) |  | 0.89(0.65,1.20) |  |
| Q3 | 185/2578 | 0.86(0.65,1.13) |  | 0.81(0.59,1.12) |  | 0.82(0.59,1.13) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 205/2776 | Ref | 0.420 | Ref | 0.898 | Ref | 0.893 |
| Q2 | 214/2659 | 0.97(0.73,1.27) |  | 1.09(0.79,1.49) |  | 1.08(0.79,1.48) |  |
| Q3 | 190/2449 | 0.89(0.66,1.19) |  | 1.02(0.73,1.43) |  | 1.02(0.73,1.43) |  |
|  |  |  |  |  |  |  |  |
| **Emphysema** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 120/1472 | Ref | 0.009 | Ref | 0.023 | Ref | 0.029 |
| Q2 | 84/1452 | 0.70(0.52,0.94) |  | 0.78(0.55,1.11) |  | 0.80(0.56,1.14) |  |
| Q3 | 74/1430 | 0.66(0.48,0.90) |  | 0.63(0.42,0.94) |  | 0.64(0.43,0.96) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 100/3116 | Ref | 0.016 | Ref | 0.057 | Ref | 0.064 |
| Q2 | 100/2422 | 0.85(0.63,1.14) |  | 0.98(0.69,1.40) |  | 0.99(0.69,1.42) |  |
| Q3 | 89/2346 | 0.66(0.47,0.92) |  | 0.65(0.42,1.01) |  | 0.66(0.42,1.02) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 79/2371 | Ref | 0.096 | Ref | 0.256 | Ref | 0.323 |
| Q2 | 93/2648 | 0.88(0.65,1.19) |  | 0.96(0.66,1.38) |  | 0.98(0.68,1.42) |  |
| Q3 | 117/2505 | 0.77(0.56,1.05) |  | 0.79(0.53,1.18) |  | 0.82(0.55,1.22) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 158/3429 | Ref | 0.054 | Ref | 0.002 | Ref | 0.003 |
| Q2 | 61/2124 | 0.69(0.50,0.95) |  | 0.68(0.46,0.97) |  | 0.67(0.46,0.97) |  |
| Q3 | 70/2331 | 0.73(0.53,1.00) |  | 0.52(0.34,0.79) |  | 0.53(0.34,0.80) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 108/2706 | Ref | 0.026 | Ref | 0.061 | Ref | 0.074 |
| Q2 | 96/2600 | 0.77(0.57,1.04) |  | 0.93(0.65,1.31) |  | 0.95(0.67,1.34) |  |
| Q3 | 85/2578 | 0.70(0.51,0.96) |  | 0.69(0.47,1.02) |  | 0.70(0.47,1.03) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 159/2776 | Ref | 0.004 | Ref | 0.186 | Ref | 0.177 |
| Q2 | 80/2659 | 0.87(0.65,1.17) |  | 1.20(0.85,1.71) |  | 1.18(0.83,1.68) |  |
| Q3 | 50/2449 | 0.61(0.43,0.85) |  | 0.76(0.50,1.14) |  | 0.75(0.50,1.13) |  |
|  |  |  |  |  |  |  |  |
| **Chronic bronchitis** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 144/1472 | Ref | 0.019 | Ref | 0.154 | Ref | 0.188 |
| Q2 | 126/1452 | 0.87(0.67,1.12) |  | 0.98(0.73,1.31) |  | 1.01(0.75,1.36) |  |
| Q3 | 106/1430 | 0.72(0.55,0.95) |  | 0.78(0.56,1.09) |  | 0.80(0.57,1.12) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 226/3116 | Ref | 0.025 | Ref | 0.147 | Ref | 0.154 |
| Q2 | 184/2422 | 1.09(0.84,1.40) |  | 1.15(0.86,1.54) |  | 1.15(0.86,1.55) |  |
| Q3 | 159/2346 | 0.71(0.53,0.95) |  | 0.77(0.54,1.09) |  | 0.77(0.54,1.10) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 185/2731 | Ref | 0.356 | Ref | 0.633 | Ref | 0.771 |
| Q2 | 184/2648 | 0.96(0.73,1.25) |  | 1.06(0.79,1.44) |  | 1.09(0.80,1.48) |  |
| Q3 | 200/2505 | 0.88(0.67,1.16) |  | 0.92(0.66,1.29) |  | 0.95(0.68,1.33) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 294/3429 | Ref | <0.001 | Ref | <0.001 | Ref | <0.001 |
| Q2 | 157/2124 | 0.92(0.71,1.19) |  | 0.80(0.59,1.07) |  | 0.79(0.58,1.06) |  |
| Q3 | 118/2331 | 0.62(0.47,0.82) |  | 0.54(0.38,0.75) |  | 0.54(0.38,0.75) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 224/2706 | Ref | 0.045 | Ref | 0.393 | Ref | 0.443 |
| Q2 | 192/2600 | 0.94(0.72,1.21) |  | 0.96(0.71,1.29) |  | 0.98(0.73,1.31) |  |
| Q3 | 153/2578 | 0.75(0.57,0.99) |  | 0.87(0.63,1.20) |  | 0.88(0.64,1.21) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 229/2776 | Ref | 0.042 | Ref | 0.173 | Ref | 0.152 |
| Q2 | 179/2659 | 0.81(0.62,1.05) |  | 0.88(0.65,1.18) |  | 0.87(0.64,1.17) |  |
| Q3 | 161/2449 | 0.75(0.56,0.99) |  | 0.80(0.58,1.10) |  | 0.79(0.57,1.09) |  |
| **Data are HRs and 95%CI;** | | | | | | | |
| **Model 1 was adjusted for age, sex, race, marriage and education;** | | | | | | | |
| **Model 2 was model 1 with additional adjustments for sport, drink, smoke, bmi, income, energy,** | | | | | | | |
| **vitamin E, vitamin C, fruit intake and vegetable intake.** | | | | | | | |
| **Model 3 was model 2 with additional adjustments for diabetes, hypertension, asthma, emphysema and chronic bronchitis.** | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Supplementary table 7 ORs and 95%CI for the association of total-carotenoids, alpha-carotene, beta-carotene, beta-cryptoxanthin,** | | | | | | | |
| **lutein/zeaxanthin and Lycopene with the prevalence of asthma, emphysema and chronic bronchitis among those excluded from follow-up of less than two years.** | | | | | | | |
| **Subgroup** | **Cases/N** | **Model 1** | | **Model 2** | | **Model 3** | |
| **OR (95%CI)** | **P** | **OR (95%CI)** | **P** | **OR (95%CI)** | **P** |
| **Asthma** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 197/2515 | Ref | 0.513 | Ref | 0.671 | Ref | 0.629 |
| Q2 | 197/2486 | 1.01(0.82,1.24) |  | 1.05(0.83,1.32) |  | 1.05(0.83,1.33) |  |
| Q3 | 182/2445 | 0.94(0.76,1.17) |  | 1.06(0.82,1.36) |  | 1.06(0.83,1.37) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 260/3084 | Ref | 0.040 | Ref | 0.227 | Ref | 0.239 |
| Q2 | 176/2346 | 0.90(0.73,1.11) |  | 1.00(0.79,1.26) |  | 1.00(0.79,1.26) |  |
| Q3 | 140/2016 | 0.78(0.62,0.98) |  | 0.84(0.64,1.11) |  | 0.85(0.64,1.12) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 202/2712 | Ref | 0.851 | Ref | 0.550 | Ref | 0.526 |
| Q2 | 185/2393 | 0.99(0.80,1.22) |  | 1.07(0.85,1.36) |  | 1.08(0.85,1.37) |  |
| Q3 | 189/2341 | 0.98(0.79,1.23) |  | 1.08(0.83,1.41) |  | 1.09(0.84,1.41) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 215/2499 | Ref | 0.986 | Ref | 0.891 | Ref | 0.402 |
| Q2 | 203/2577 | 0.96(0.78,1.17) |  | 0.98(0.78,1.23) |  | 0.98(0.78,1.23) |  |
| Q3 | 158/2370 | 0.91(0.73,1.14) |  | 1.02(0.78,1.33) |  | 1.02(0.78,1.34) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 243/2674 | Ref | 0.050 | Ref | 0.068 | Ref | 0.075 |
| Q2 | 173/2510 | 0.76(0.62,0.94) |  | 0.76(0.60,0.96) |  | 0.76(0.61, 0.96) |  |
| Q3 | 160/2262 | 0.79(0.63,0.98) |  | 0.79(0.62,1.02) |  | 0.80(0.62, 1.02) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 198/2672 | Ref | 0.426 | Ref | 0.241 | Ref | 0.229 |
| Q2 | 187/2305 | 1.07(0.86,1.33) |  | 1.21(0.95,1.54) |  | 1.21(0.95,1.54) |  |
| Q3 | 191/2469 | 1.00(0.80,1.24) |  | 1.16(0.91,1.49) |  | 1.16(0.91,1.49) |  |
|  |  |  |  |  |  |  |  |
| **Emphysema** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 115/2515 | Ref | 0.005 | Ref | 0.006 | Ref | 0.009 |
| Q2 | 82/2486 | 0.80( 0.59, 1.08) |  | 0.96( 0.67,1.37) |  | 0.98( 0.68,1.41) |  |
| Q3 | 72/2445 | 0.60( 0.44, 0.82) |  | 0.57( 0.38,0.85) |  | 0.59( 0.39,0.87) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 100/3084 | Ref | 0.121 | Ref | 0.162 | Ref | 0.205 |
| Q2 | 97/2346 | 0.99( 0.73, 1.33) |  | 1.14( 0.79,1.63) |  | 1.16( 0.81,1.68) |  |
| Q3 | 72/2016 | 0.70( 0.50, 0.98) |  | 0.73( 0.48,1.13) |  | 0.75( 0.49,1.16) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 79/2712 | Ref | 0.285 | Ref | 0.784 | Ref | 0.834 |
| Q2 | 83/2393 | 0.86( 0.62, 1.20) |  | 0.97( 0.65,1.44) |  | 0.96( 0.65,1.43) |  |
| Q3 | 107/2341 | 0.85( 0.62, 1.17) |  | 0.95( 0.63,1.42) |  | 0.96( 0.64,1.44) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 128/2499 | Ref | 0.052 | Ref | 0.009 | Ref | 0.009 |
| Q2 | 71/2577 | 0.66( 0.48, 0.89) |  | 0.75( 0.52,1.07) |  | 0.76( 0.53,1.08) |  |
| Q3 | 70/2370 | 0.74( 0.54, 1.02) |  | 0.57( 0.37,0.87) |  | 0.57( 0.37,0.86) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 107/2674 | Ref | 0.014 | Ref | 0.082 | Ref | 0.102 |
| Q2 | 92/2510 | 0.88( 0.65, 1.18) |  | 1.13( 0.79,1.6) |  | 1.16( 0.81,1.65) |  |
| Q3 | 70/2262 | 0.66( 0.48, 0.91) |  | 0.70( 0.47,1.04) |  | 0.72( 0.48,1.07) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 152/2672 | Ref | 0.034 | Ref | 0.095 | Ref | 0.098 |
| Q2 | 66/2305 | 0.72( 0.53, 0.98) |  | 0.86( 0.59,1.23) |  | 0.86( 0.59,1.23) |  |
| Q3 | 51/2469 | 0.62( 0.44, 0.87) |  | 0.71( 0.47,1.06) |  | 0.71( 0.47,1.06) |  |
|  |  |  |  |  |  |  |  |
| **Chronic bronchitis** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 196/2515 | Ref | 0.012 | Ref | 0.150 | Ref | 0.202 |
| Q2 | 196/2486 | 1.07(0.86,1.32) |  | 1.12(0.89,1.43) |  | 1.15(0.90,1.46) |  |
| Q3 | 152/2445 | 0.78(0.62,0.98) |  | 0.82(0.63,1.07) |  | 0.84(0.64,1.10) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 225/3084 | Ref | 0.063 | Ref | 0.247 | Ref | 0.273 |
| Q2 | 176/2346 | 0.95(0.76,1.17) |  | 0.97(0.76,1.24) |  | 0.98(0.77,1.25) |  |
| Q3 | 143/2016 | 0.81(0.64,1.03) |  | 0.84(0.63,1.12) |  | 0.85(0.64,1.13) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 185/2712 | Ref | 0.173 | Ref | 0.247 | Ref | 0.327 |
| Q2 | 173/2393 | 0.90(0.72,1.13) |  | 0.99(0.77,1.26) |  | 1.00(0.78,1.28) |  |
| Q3 | 186/2341 | 0.84(0.66,1.05) |  | 0.85(0.65,1.12) |  | 0.87(0.66,1.15) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 231/2499 | Ref | 0.002 | Ref | 0.006 | Ref | 0.006 |
| Q2 | 180/2577 | 0.83(0.68,1.03) |  | 0.77(0.60,0.97) |  | 0.76(0.60,0.97) |  |
| Q3 | 133/2370 | 0.71(0.56,0.90) |  | 0.68(0.51,0.89) |  | 0.68(0.51,0.89) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 222/2674 | Ref | 0.020 | Ref | 0.303 | Ref | 0.343 |
| Q2 | 183/2510 | 0.95(0.77,1.17) |  | 1.04(0.82,1.32) |  | 1.05(0.83,1.33) |  |
| Q3 | 139/2262 | 0.78(0.62,0.99) |  | 0.87(0.67,1.13) |  | 0.88(0.67,1.15) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 223/2672 | Ref | 0.587 | Ref | 0.875 | Ref | 0.912 |
| Q2 | 155/2305 | 0.86(0.69,1.07) |  | 0.92(0.72,1.18) |  | 0.93(0.72,1.18) |  |
| Q3 | 166/2469 | 0.92(0.73,1.15) |  | 0.98(0.76,1.26) |  | 0.99(0.76,1.27) |  |
| **Data are HRs and 95%CI;** | | | | | | | |
| **Model 1 was adjusted for age, sex, race, marriage and education;** | | | | | | | |
| **Model 2 was model 1 with additional adjustments for sport, drink, smoke, bmi, income, energy,** | | | | | | | |
| **vitamin E, vitamin C, fruit intake and vegetable intake.** | | | | | | | |
| **Model 3 was model 2 with additional adjustments for diabetes, hypertension, asthma, emphysema and chronic bronchitis.** | | | | | | | |

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| **Supplementary table 8 ORs and 95%CI for the association of total-carotenoids, alpha-carotene, beta-carotene, beta-cryptoxanthin,** | | | | | | | |
| **lutein/zeaxanthin and Lycopene with the prevalence of asthma, emphysema and chronic bronchitis in populations excluding limit values.** | | | | | | | |
| **Subgroup** | **Cases/N** | **Model 1** | | **Model 2** | | **Model 3** | |
| **OR (95%CI)** | **P** | **OR (95%CI)** | **P** | **OR (95%CI)** | **P** |
| **Asthma** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 205/2617 | Ref | 0.513 | Ref | 0.696 | Ref | 0.675 |
| Q2 | 197/2566 | 0.98(0.80, 1.21) |  | 1.08(0.85,1.36) |  | 1.08(0.86,1.36) |  |
| Q3 | 177/2429 | 0.93(0.75, 1.15) |  | 1.05(0.81,1.36) |  | 1.06(0.82,1.37) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 251/3001 | Ref | 0.040 | Ref | 0.241 | Ref | 0.249 |
| Q2 | 172/2337 | 0.90(0.73, 1.11) |  | 1.00(0.79,1.27) |  | 1.01(0.79,1.27) |  |
| Q3 | 156/2274 | 0.79(0.63, 0.99) |  | 0.85(0.65,1.12) |  | 0.85(0.65,1.12) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 198/2650 | Ref | 0.851 | Ref | 0.457 | Ref | 0.448 |
| Q2 | 289/2557 | 0.94(0.76, 1.16) |  | 1.03(0.82,1.31) |  | 1.04(0.82,1.31) |  |
| Q3 | 192/2405 | 0.98(0.78, 1.22) |  | 1.11(0.85,1.44) |  | 1.11(0.85,1.44) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 266/3283 | Ref | 0.986 | Ref | 0.242 | Ref | 0.402 |
| Q2 | 161/2060 | 1.02(0.83, 1.26) |  | 1.10(0.87,1.39) |  | 1.10(0.87,1.39) |  |
| Q3 | 152/2269 | 1.00(0.80, 1.25) |  | 1.17(0.90,1.52) |  | 1.17(0.90,1.52) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 232/2602 | Ref | 0.050 | Ref | 0.077 | Ref | 0.083 |
| Q2 | 172/2521 | 0.77(0.63, 0.95) |  | 0.76(0.60,0.96) |  | 0.76(0.60,0.96) |  |
| Q3 | 175/2489 | 0.81(0.65, 1.00) |  | 0.80(0.62,1.02) |  | 0.80(0.63,1.03) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 184/2598 | Ref | 0.426 | Ref | 0.158 | Ref | 0.157 |
| Q2 | 206/2598 | 1.10(0.89, 1.36) |  | 1.22(0.96,1.55) |  | 1.22(0.96,1.55) |  |
| Q3 | 189/2416 | 1.05(0.84, 1.32) |  | 1.20(0.93,1.54) |  | 1.20(0.93,1.54) |  |
|  |  |  |  |  |  |  |  |
| **Emphysema** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 107/2617 | Ref | 0.005 | Ref | 0.025 | Ref | 0.030 |
| Q2 | 72/2566 | 0.72( 0.53, 0.99) |  | 0.84( 0.58, 1.22) |  | 0.87( 0.59,1.26) |  |
| Q3 | 68/2429 | 0.63( 0.45, 0.87) |  | 0.62( 0.41, 0.94) |  | 0.63( 0.41,0.95) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 83/3001 | Ref | 0.121 | Ref | 0.644 | Ref | 0.720 |
| Q2 | 87/2337 | 1.00( 0.72, 1.38) |  | 1.26( 0.85, 1.85) |  | 1.29( 0.88,1.91) |  |
| Q3 | 77/2274 | 0.76( 0.54, 1.07) |  | 0.90( 0.58, 1.41) |  | 0.92( 0.59,1.44) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 69/2650 | Ref | 0.285 | Ref | 0.914 | Ref | 0.917 |
| Q2 | 78/2557 | 0.83( 0.59, 1.18) |  | 1.07( 0.71, 1.63) |  | 1.06( 0.70,1.62) |  |
| Q3 | 100/2405 | 0.83( 0.60, 1.17) |  | 1.02( 0.67, 1.58) |  | 1.02( 0.67,1.58) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 136/3283 | Ref | 0.052 | Ref | 0.005 | Ref | 0.006 |
| Q2 | 54/2060 | 0.73( 0.52, 1.01) |  | 0.75( 0.51, 1.09) |  | 0.74( 0.50,1.08) |  |
| Q3 | 57/2269 | 0.72( 0.51, 1.00) |  | 0.53( 0.33, 0.82) |  | 0.53( 0.33,0.83) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 93/2602 | Ref | 0.014 | Ref | 0.149 | Ref | 0.190 |
| Q2 | 86/2521 | 0.92( 0.67, 1.26) |  | 1.12( 0.77, 1.62) |  | 1.16( 0.80,1.69) |  |
| Q3 | 68/2489 | 0.66( 0.47, 0.92) |  | 0.74( 0.49, 1.11) |  | 0.76( 0.50,1.15) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 133/2598 | Ref | 0.034 | Ref | 0.280 | Ref | 0.263 |
| Q2 | 66/2598 | 0.72( 0.52, 0.98) |  | 0.86( 0.59, 1.23) |  | 0.85( 0.58,1.22) |  |
| Q3 | 48/2416 | 0.68( 0.47, 0.97) |  | 0.79( 0.52, 1.20) |  | 0.79( 0.51,1.19) |  |
|  |  |  |  |  |  |  |  |
| **Chronic bronchitis** |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |
| Q1 | 202/2617 | Ref | 0.012 | Ref | 0.342 | Ref | 0.400 |
| Q2 | 187/2566 | 0.99(0.80,1.22) |  | 1.13(0.89, 1.44) |  | 1.16(0.91, 1.48) |  |
| Q3 | 141/2429 | 0.74(0.59,0.94) |  | 0.87(0.66, 1.15) |  | 0.89(0.67, 1.17) |  |
| alpha-carotene |  |  |  |  |  |  |  |
| Q1 | 213/3001 | Ref | 0.063 | Ref | 0.456 | Ref | 0.496 |
| Q2 | 170/2337 | 0.97(0.77,1.20) |  | 1.03(0.80, 1.32) |  | 1.04(0.81, 1.33) |  |
| Q3 | 147/2274 | 0.80(0.63,1.01) |  | 0.90(0.67, 1.19) |  | 0.90(0.68, 1.21) |  |
| beta-carotene |  |  |  |  |  |  |  |
| Q1 | 176/2650 | Ref | 0.173 | Ref | 0.721 | Ref | 0.856 |
| Q2 | 173/2557 | 0.87(0.70,1.10) |  | 0.99(0.77, 1.28) |  | 1.00(0.78, 1.29) |  |
| Q3 | 181/2405 | 0.85(0.67,1.07) |  | 0.95(0.72, 1.26) |  | 0.97(0.73, 1.29) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |
| Q1 | 273/3283 | Ref | 0.002 | Ref | 0.012 | Ref | 0.013 |
| Q2 | 149/2060 | 0.95(0.77,1.18) |  | 0.95(0.75, 1.20) |  | 0.95(0.74, 1.20) |  |
| Q3 | 108/2269 | 0.68(0.53,0.86) |  | 0.69(0.51, 0.92) |  | 0.69(0.51, 0.92) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |
| Q1 | 211/2602 | Ref | 0.020 | Ref | 0.284 | Ref | 0.322 |
| Q2 | 177/2521 | 0.94(0.76,1.17) |  | 1.04(0.82, 1.32) |  | 1.05(0.83, 1.34) |  |
| Q3 | 142/2489 | 0.76(0.60,0.96) |  | 0.86(0.66, 1.13) |  | 0.87(0.67, 1.14) |  |
| Lycopene |  |  |  |  |  |  |  |
| Q1 | 205/2598 | Ref | 0.587 | Ref | 0.724 | Ref | 0.726 |
| Q2 | 167/2598 | 0.86(0.69,1.07) |  | 0.95(0.74, 1.21) |  | 0.95(0.74, 1.21) |  |
| Q3 | 158/2416 | 0.94(0.74,1.18) |  | 1.05(0.81, 1.36) |  | 1.05(0.81, 1.36) |  |
| **Data are HRs and 95%CI;** | | | | | | | |
| **Model 1 was adjusted for age, sex, race, marriage and education;** | | | | | | | |
| **Model 2 was model 1 with additional adjustments for sport, drink, smoke, educatio, bmi, income, energy,** | | | | | | | |
| **vitamin E, vitamin C, fruit intake and vegetable intake.** | | | | | | | |
| **Model 3 was model 2 with additional adjustments for diabetes, hypertension, asthma, emphysema and chronic bronchitis.** | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Supplementary table 9 ORs and 95%CI for the association of total-carotenoids, alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein/zeaxanthin and Lycopene with the prevalence of asthma, emphysema and chronic bronchitis grouped by smoking or not.** | | | | | | | | | | | | | | |
| **Subgroup** | **Cases/N** | **Never⁄ Former smokers (n=3913)** | | | | | | **Cases/N** | **Current smokers (n=3971)** | | | | | |
| **Model 1** | | **Model 2** | | **Model 3** | | **Model 1** | | **Model 2** | | **Model 3** | |
| **OR (95%CI)** | **P** | **OR (95%CI)** | **P** | **OR (95%CI)** | **P** | **OR (95%CI)** | **P** | **OR (95%CI)** | **P** | **OR (95%CI)** | **P** |
| **Asthma** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 112/1307 | Ref | 0.196 | Ref | 0.465 | Ref | 0.4965 | 79/1045 | Ref | 0.730 | Ref | 0.15085 | Ref | 0.14056 |
| Q2 | 102/1336 | 0.89(0.67,1.19) |  | 0.87(0.63,1.19) |  | 0.87(0.64,1.20) |  | 91/1254 | 0.92(0.67,1.26) |  | 1.04(0.74,1.48) |  | 1.04(0.74,1.48) |  |
| Q3 | 85/1270 | 0.82(0.61,1.11) |  | 0.88(0.62,1.24) |  | 0.89(0.62,1.26) |  | 140/1672 | 1.05(0.79,1.42) |  | 1.29(0.91,1.83) |  | 1.30(0.92,1.84) |  |
| alpha-carotene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 139/1532 | Ref | 0.002125 | Ref | 0.063946 | Ref | 0.0628 | 80/1058 | Ref | 0.748796 | Ref | 0.977 | Ref | 0.950 |
| Q2 | 93/1136 | 0.93(0.70,1.23) |  | 1.07(0.78,1.47) |  | 1.07(0.78,1.47) |  | 105/1292 | 1.10(0.81,1.51) |  | 1.15(0.82,1.60) |  | 1.15(0.82,1.61) |  |
| Q3 | 67/1245 | 0.60(0.43,0.83) |  | 0.70(0.48,1.02) |  | 0.70(0.48,1.02) |  | 125/1621 | 0.95(0.70,1.30) |  | 1.01(0.71,1.44) |  | 1.01(0.71,1.45) |  |
| beta-carotene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 120/1503 | Ref | 0.0879 | Ref | 0.25269 | Ref | 0.286 | 61/988 | Ref | 0.099399 | Ref | 0.03238 | Ref | 0.030 |
| Q2 | 96/1154 | 1.00(0.75,1.33) |  | 1.00(0.72,1.37) |  | 1.01(0.73,1.38) |  | 99/1310 | 1.17(0.84,1.64) |  | 1.20(0.84,1.73) |  | 1.21(0.85,1.75) |  |
| Q3 | 83/1256 | 0.76(0.56,1.04) |  | 0.81(0.57,1.16) |  | 0.82(0.58,1.17) |  | 150/1673 | 1.31(0.95,1.83) |  | 1.49(1.04,2.16) |  | 1.50(1.05,2.18) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 145/1530 | Ref | 0.028 | Ref | 0.13917 | Ref | 0.344 | 103/1402 | Ref | 0.340887 | Ref | 0.03159 | Ref | 0.34405 |
| Q2 | 90/1153 | 0.87(0.65,1.15) |  | 0.88(0.64,1.19) |  | 0.89(0.65,1.21) |  | 93/1097 | 1.18(0.87,1.58) |  | 1.36(0.98,1.88) |  | 1.36(0.98,1.88) |  |
| Q3 | 64/1230 | 0.70(0.50,0.96) |  | 0.76(0.52,1.09) |  | 0.76(0.52,1.09) |  | 114/1472 | 1.15(0.86,1.54) |  | 1.45(1.03,2.04) |  | 1.46(1.04,2.06) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 129/1393 | Ref | 0.12259 | Ref | 0.283686 | Ref | 0.291 | 99/1107 | Ref | 0.130953 | Ref | 0.24199 | Ref | 0.24829 |
| Q2 | 90/1350 | 0.73(0.54,0.97) |  | 0.73(0.53,1.01) |  | 0.73(0.53,1.01) |  | 98/1314 | 0.83(0.62,1.12) |  | 0.84(0.61,1.16) |  | 0.84(0.61,1.16) |  |
| Q3 | 80/1170 | 0.78(0.57,1.07) |  | 0.82(0.58,1.17) |  | 0.83(0.58,1.18) |  | 113/1550 | 0.80(0.60,1.07) |  | 0.83(0.60,1.14) |  | 0.83(0.60,1.14) |  |
| Lycopene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 95/1305 | Ref | 0.949 | Ref | 0.800 | Ref | 0.755 | 110/1471 | Ref | 0.927551 | Ref | 0.400 | Ref | 0.40335 |
| Q2 | 108/1343 | 1.09(0.81,1.47) |  | 1.08(0.78,1.51) |  | 1.09(0.78,1.52) |  | 106/1316 | 1.03(0.77,1.38) |  | 1.20(0.88,1.64) |  | 1.20(0.88,1.64) |  |
| Q3 | 96/1265 | 0.99(0.72,1.35) |  | 1.05(0.74,1.48) |  | 1.06(0.75,1.50) |  | 94/1184 | 1.01(0.74,1.39) |  | 1.16(0.82,1.63) |  | 1.16(0.82,1.62) |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Emphysema** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 45/1307 | Ref | 0.2168 | Ref | 0.122 | Ref | 0.118 | 70/1045 | Ref | 0.031019 | Ref | 0.120918 | Ref | 0.141254 |
| Q2 | 29/1336 | 0.70(0.42,1.15) |  | 0.85(0.48,1.47) |  | 0.85(0.48,1.48) |  | 53/1254 | 0.78(0.53,1.14) |  | 0.83(0.53,1.31) |  | 0.85(0.54, 1.35) |  |
| Q3 | 74/1430 | 0.73(0.45,1.20) |  | 0.62(0.33,1.13) |  | 0.64(0.43,0.96) |  | 60/1672 | 0.66(0.46,0.96) |  | 0.69(0.43, 1.11) |  | 0.70(0.43, 1.13) |  |
| alpha-carotene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 32/1532 | Ref | 0.8275 | Ref | 0.75133 | Ref | 0.6965 | 53/1058 | Ref | 0.218082 | Ref | 0.882169 | Ref | 0.953322 |
| Q2 | 41/1136 | 1.57(0.95,2.62) |  | 1.62(0.91,2.92) |  | 1.60(0.89,2.90) |  | 59/1292 | 0.84(0.57,1.26) |  | 1.04(0.64, 1.68) |  | 1.04(0.65, 1.70) |  |
| Q3 | 33/1245 | 0.94(0.55,1.62) |  | 1.11(0.58,2.12) |  | 1.14(0.60,2.18) |  | 71/1621 | 0.78(0.53,1.16) |  | 0.96(0.58, 1.60) |  | 0.98(0.60, 1.65) |  |
| beta-carotene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 30/1503 | Ref | 0.511 | Ref | 0.20389 | Ref | 0.215 | 42/988 | Ref | 0.552996 | Ref | 0.668736 | Ref | 0.671546 |
| Q2 | 35/1154 | 1.25(0.74,2.13) |  | 1.21(0.67,2.17) |  | 1.23(0.68,2.23) |  | 56/1310 | 0.84(0.55,1.30) |  | 1.04(0.62, 1.77) |  | 1.04(0.62, 1.77) |  |
| Q3 | 41/1256 | 0.84(0.50,1.42) |  | 0.66(0.35,1.25) |  | 0.66(0.35,1.27) |  | 85/1673 | 0.89(0.59,1.33) |  | 1.12(0.68, 1.88) |  | 1.12(0.67, 1.89) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 55/1530 | Ref | 0.757 | Ref | 0.259513 | Ref | 0.232 | 91/1402 | Ref | 0.232594 | Ref | 0.162726 | Ref | 0.187879 |
| Q2 | 23/1153 | 0.80(0.47,1.34) |  | 0.84(0.47,1.47) |  | 0.88(0.49,1.54) |  | 37/1097 | 0.65(0.43,0.97) |  | 0.76(0.48, 1.20) |  | 0.77(0.48, 1.22) |  |
| Q3 | 28/1230 | 0.92(0.55,1.52) |  | 0.70(0.36,1.29) |  | 0.53(0.34,0.80) |  | 55/1472 | 0.80(0.55,1.15) |  | 0.71(0.44, 1.14) |  | 0.72(0.44, 1.17) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 38/1393 | Ref | 0.4266 | Ref | 0.553 | Ref | 0.596 | 63/1107 | Ref | 0.221091 | Ref | 0.269772 | Ref | 0.32687 |
| Q2 | 37/1350 | 1.03(0.63,1.67) |  | 1.13(0.65,1.97) |  | 1.14(0.65,1.99) |  | 59/1314 | 0.88(0.60,1.29) |  | 0.96(0.61, 1.51) |  | 0.99(0.63, 1.56) |  |
| Q3 | 31/1170 | 0.81(0.48,1.36) |  | 0.83( 0.45,1.53) |  | 0.85(0.46,1.56) |  | 61/1550 | 0.79(0.54,1.15) |  | 0.77(0.49, 1.22) |  | 0.79(0.50, 1.26) |  |
| Lycopene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 52/1305 | Ref | 0.4471 | Ref | 0.92887 | Ref | 0.929 | 107/1471 | Ref | 0.010643 | Ref | 0.052695 | Ref | 0.057157 |
| Q2 | 31/1343 | 0.92(0.56,1.48) |  | 1.09(0.62,1.89) |  | 1.06(0.60,1.84) |  | 49/1316 | 0.74(0.51,1.05) |  | 0.77(0.50, 1.17) |  | 0.77(0.50, 1.17) |  |
| Q3 | 23/1265 | 0.81(0.46,1.38) |  | 1.03(0.55,1.89) |  | 1.03(0.55,1.90) |  | 27/1184 | 0.55(0.34,0.86) |  | 0.59(0.34,0.99) |  | 0.59(0.34, 1.00) |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Chronic bronchitis** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| total-carotenoids |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 111/1307 | Ref | 0.030 | Ref | 0.124 | Ref | 0.1527 | 85/1045 | Ref | 0.28168 | Ref | 0.68724 | Ref | 0.75432 |
| Q2 | 95/1336 | 0.89(0.66, 1.19) |  | 0.93(0.67, 1.28) |  | 0.95(0.68, 1.32) |  | 92/1254 | 0.95(0.69,1.30) |  | 1.10(0.78,1.56) |  | 1.12(0.79,1.60) |  |
| Q3 | 74/1270 | 0.70(0.51,0.96) |  | 0.75(0.51, 1.08) |  | 0.76(0.52, 1.11) |  | 112/1672 | 0.85(0.62,1.15) |  | 0.93(0.65,1.34) |  | 0.94(0.66,1.36) |  |
| alpha-carotene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 117/1532 | Ref | 0.00212 | Ref | 0.0164 | Ref | 0.022 | 68/1058 | Ref | 0.79826 | Ref | 0.47216 | Ref | 0.43434 |
| Q2 | 97/1136 | 1.06(0.79, 1.42) |  | 1.07(0.77, 1.49) |  | 1.07(0.77, 1.49) |  | 102/1292 | 1.20(0.86,1.66) |  | 1.33(0.93,1.92) |  | 1.34(0.93,1.93) |  |
| Q3 | 66/1245 | 0.58(0.41,0.82) |  | 0.61(0.41,0.91) |  | 0.63(0.42, 0.93) |  | 119/1621 | 1.04(0.75,1.45) |  | 1.15(0.79,1.70) |  | 1.17(0.80,1.72) |  |
| beta-carotene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 103/1503 | Ref | 0.06688 | Ref | 0.151 | Ref | 0.200 | 61/988 | Ref | 0.98765 | Ref | 0.700 | Ref | 0.6532 |
| Q2 | 89/1154 | 0.96(0.70, 1.30) |  | 1.00(0.71, 1.40) |  | 1.02(0.72, 1.42) |  | 92/1310 | 0.98(0.70,1.39) |  | 1.13(0.78,1.65) |  | 1.13(0.78,1.66) |  |
| Q3 | 88/1256 | 0.74(0.53, 1.02) |  | 0.76(0.52, 1.10) |  | 0.78(0.53, 1.14) |  | 136/1673 | 1.00(0.72,1.40) |  | 1.08(0.74,1.59) |  | 1.09(0.75,1.62) |  |
| beta-cryptoxanthin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 136/1530 | Ref | 0.06523 | Ref | 0.041 | Ref | 0.034 | 123/1402 | Ref | 0.07119 | Ref | 0.16402 | Ref | 0.16199 |
| Q2 | 79/1153 | 0.87(0.65, 1.18) |  | 0.83(0.60, 1.15) |  | 0.84(0.60, 1.17) |  | 79/1097 | 0.86(0.64,1.16) |  | 0.84(0.60,1.18) |  | 0.83(0.59,1.17) |  |
| Q3 | 65/1230 | 0.73(0.53, 1.02) |  | 0.67(0.45,0.98) |  | 0.65(0.44, 0.96) |  | 87/1472 | 0.76(0.56,1.02) |  | 0.78(0.55,1.11) |  | 0.78(0.54,1.11) |  |
| lutein/zeaxanthin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 122/1393 | Ref | 0.05845 | Ref | 0.227 | Ref | 0.2847 | 96/1107 | Ref | 0.10036 | Ref | 0.28253 | Ref | 0.305088 |
| Q2 | 94/1350 | 0.90(0.67, 1.20) |  | 1.02(0.74, 1.41) |  | 1.03(0.75, 1.43) |  | 94/1314 | 0.88(0.65,1.19) |  | 0.87(0.63,1.22) |  | 0.88(0.63,1.24) |  |
| Q3 | 64/1170 | 0.72(0.51, 1.01) |  | 0.79(0.53, 1.16) |  | 0.81(0.54, 1.19) |  | 99/1550 | 0.77(0.57,1.05) |  | 0.83(0.59,1.17) |  | 0.84(0.59,1.18) |  |
| Lycopene |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Q1 | 99/1305 | Ref | 0.8437 | Ref | 0.6378 | Ref | 0.6249 | 130/1471 | Ref | 0.57024 | Ref | 0.77404 | Ref | 0.77644 |
| Q2 | 97/1343 | 1.04(0.76, 1.41) |  | 1.09(0.77, 1.53) |  | 1.06(0.75, 1.49) |  | 82/1316 | 0.76(0.56,1.03) |  | 0.84(0.60,1.16) |  | 0.84(0.61,1.17) |  |
| Q3 | 84/1265 | 0.97(0.70, 1.34) |  | 1.09(0.76, 1.57) |  | 1.09(0.76, 1.58) |  | 77/1184 | 0.91(0.66,1.25) |  | 0.95(0.67,1.35) |  | 0.95(0.67,1.35) |  |
| **Data are HRs and 95%CI;** | | | | | | | | | | | | | | |
| **Model 1 was adjusted for age, sex, race, marriage and education;** | | | | | | | | | | | | | | |
| **Model 2 was model 1 with additional adjustments for sport, drink, smoke, bmi, income, energy,** | | | | | | | | | | | | | | |
| **vitamin E, vitamin C, fruit intake and vegetable intake.** | | | | | | | | | | | | | | |
| **Model 3 was model 2 with additional adjustments for diabetes, hypertension, asthma, emphysema and chronic bronchitis.** | | | | | | | | | | | | | | |