

**An epidemiological study of the risk factors associated with myopia in young adult men in Korea**

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**Supplementary Table S1.** Demographic Characteristics of All Participants Over a 5-Year Period (2009–2013)

| Characteristics |                                               | 2009           | 2010           | 2011           | 2012           | 2013           |
|-----------------|-----------------------------------------------|----------------|----------------|----------------|----------------|----------------|
|                 |                                               | (n = 328,627)  | (n = 356,251)  | (n = 370,737)  | (n = 364,156)  | (n = 364,848)  |
| Birth season    | Spring (%)                                    | 74,854 (22.8)  | 81,588 (22.9)  | 87,771 (23.7)  | 91,319 (25.1)  | 92,644 (25.4)  |
|                 | Summer (%)                                    | 76,415 (23.3)  | 82,112 (23.0)  | 86,001 (23.2)  | 85,179 (23.4)  | 85,858 (23.5)  |
|                 | Autumn (%)                                    | 78,858 (24.0)  | 91,314 (25.6)  | 93,785 (25.3)  | 88,640 (24.3)  | 90,166 (24.7)  |
|                 | Winter (%)                                    | 98,500 (30.0)  | 101,238 (28.4) | 103,180 (27.8) | 99,018 (27.2)  | 96,180 (26.4)  |
| Education level | High school education or less (%)             | 86,467 (26.3)  | 102,305 (28.7) | 118,396 (31.9) | 119,327 (35.5) | 139,107 (38.1) |
|                 | 2- to 3-year college education (%)            | 79,810 (24.3)  | 85,943 (24.1)  | 89,836 (24.2)  | 82,114 (22.5)  | 76,377 (20.9)  |
|                 | 4- or 6-year university education or more (%) | 162,350 (49.4) | 168,003 (47.2) | 162,505 (43.8) | 152,715 (41.9) | 149,364 (40.9) |
| Height (cm)     | ≤170 (%)                                      | 92,289 (28.1)  | 100,410 (28.2) | 101,808 (27.5) | 104,484 (28.7) | 105,720 (29.0) |
|                 | 171–174 (%)                                   | 89,176 (27.1)  | 97,285 (27.3)  | 101,332 (27.3) | 99,625 (27.4)  | 100,450 (27.5) |
|                 | 175–178 (%)                                   | 79,772 (24.3)  | 86,073 (24.2)  | 90,482 (24.4)  | 87,218 (24.0)  | 67,947 (18.6)  |
|                 | ≥179 (%)                                      | 67,390 (20.5)  | 72,484 (20.3)  | 77,115 (20.8)  | 72,829 (20.0)  | 90,731 (24.9)  |
|                 | Mean ± SD                                     | 173.83 ± 5.73  | 173.80 ± 5.72  | 173.90 ± 5.72  | 173.73 ± 5.73  | 173.67 ± 5.75  |
| Weight (kg)     | ≤60 (%)                                       | 90,614 (27.6)  | 98,239 (27.6)  | 103,151 (27.8) | 103,035 (28.3) | 103,085 (28.3) |
|                 | 61–66 (%)                                     | 75,422 (23.0)  | 82,193 (23.1)  | 85,055 (22.9)  | 81,818 (22.5)  | 80,335 (22.0)  |

|                          |                 |                |                |                |                |                |
|--------------------------|-----------------|----------------|----------------|----------------|----------------|----------------|
|                          | 67–75 (%)       | 86,634 (26.4)  | 93,888 (26.4)  | 96,798 (26.1)  | 94,160 (25.9)  | 92,764 (25.4)  |
|                          | ≥76 (%)         | 75,957 (23.1)  | 81,931 (23.0)  | 85,733 (23.1)  | 85,143 (23.4)  | 88,664 (24.3)  |
|                          | Mean ± SD       | 68.46 ± 12.70  | 68.44 ± 12.71  | 68.43 ± 12.76  | 68.42 ± 12.90  | 68.67 ± 13.24  |
| BMI (kg/m <sup>2</sup> ) | <18.5 (%)       | 32,743 (10.0)  | 35,179 (9.9)   | 37,255 (10.0)  | 37,442 (10.3)  | 38,441 (10.5)  |
|                          | 18.5–22.99 (%)  | 171,267 (52.1) | 186,604 (52.4) | 194,888 (52.6) | 187,660 (51.5) | 183,393 (50.3) |
|                          | 23.00–24.99 (%) | 53,921 (16.4)  | 58,304 (16.4)  | 59,774 (16.1)  | 59,492 (16.3)  | 59,173 (16.2)  |
|                          | ≥25.0 (%)       | 70,696 (21.5)  | 76,164 (21.4)  | 78,820 (21.3)  | 79,562 (21.8)  | 83,841 (23.0)  |
|                          | Mean ± SD       | 22.63 ± 3.87   | 22.63 ± 3.88   | 22.60 ± 3.88   | 22.64 ± 3.92   | 22.73 ± 4.03   |
| Age (years)              | Mean ± SD       | 19.02 ± 0.45   | 19.02 ± 0.46   | 19.02 ± 0.46   | 19.02 ± 0.44   | 19.03 ± 0.43   |

BMI = body mass index; SD = standard deviation.

**Supplementary Table S2.** Prevalence of Myopia According to Possible Risk Factors

| Risk factor     |                                           | Prevalence of myopia (%) |                   |          |                   |          |                   |          |                   |          |                   |
|-----------------|-------------------------------------------|--------------------------|-------------------|----------|-------------------|----------|-------------------|----------|-------------------|----------|-------------------|
|                 |                                           | 2009                     |                   | 2010     |                   | 2011     |                   | 2012     |                   | 2013     |                   |
|                 |                                           | % (n)                    | <i>P</i> -value** | % (n)    | <i>P</i> -value** | % (n)    | <i>P</i> -value** | % (n)    | <i>P</i> -value** | % (n)    | <i>P</i> -value** |
|                 |                                           |                          |                   |          |                   |          |                   |          |                   |          |                   |
| Birth season    | Spring                                    | 51.2*                    | <0.001            | 54.2*    | <0.001            | 51.5*    | <0.001            | 51.9*    | <0.001            | 52.0*    | <0.01             |
|                 |                                           | (38,315)                 |                   | (44,225) |                   | (45,211) |                   | (47,388) |                   | (48,177) |                   |
|                 | Summer                                    | 51.3*                    |                   | 52.8     |                   | 50.9*    |                   | 51.2     |                   | 51.5*    |                   |
|                 |                                           | (39,165)                 |                   | (43,379) |                   | (43,764) |                   | (43,605) |                   | (44,250) |                   |
|                 | Autumn                                    | 49.9                     |                   | 52.9     |                   | 49.9     |                   | 51.2     |                   | 51.3     |                   |
|                 |                                           | (39,345)                 |                   | (48,326) |                   | (46,784) |                   | (45,421) |                   | (46,291) |                   |
|                 | Winter                                    | 51.0*                    |                   | 52.2     |                   | 50.1     |                   | 50.7     |                   | 51.1     |                   |
|                 |                                           | (50,212)                 |                   | (52,831) |                   | (51,732) |                   | (50,236) |                   | (49,179) |                   |
| Education level | High school education or less             | 47.8                     | <0.001            | 51.8     | <0.001            | 47.3     | <0.001            | 47.9     | <0.001            | 48.3     | <0.001            |
|                 |                                           | (41,351)                 |                   | (52,961) |                   | (56,045) |                   | (61,888) |                   | (67,189) |                   |
|                 | 2- to 3-year college education            | 40.4                     |                   | 43.3     |                   | 42.3     |                   | 44.2     |                   | 45.5     |                   |
|                 |                                           | (32,204)                 |                   | (37,195) |                   | (38,007) |                   | (36,293) |                   | (34,770) |                   |
|                 | 4- or 6-year university education or more | 57.6*                    |                   | 58.7*    |                   | 57.5*    |                   | 57.9*    |                   | 57.5*    |                   |
|                 |                                           | (93,482)                 |                   | (98,605) |                   | (93,439) |                   | (88,469) |                   | (85,938) |                   |

|                      |  |          |        |          |        |          |        |          |        |          |       |
|----------------------|--|----------|--------|----------|--------|----------|--------|----------|--------|----------|-------|
| Height (cm) ≤170     |  | 50.3     | <0.01  | 52.6     | <0.05  | 50.7*    | <0.05  | 51.3     | >0.05  | 51.7*    | <0.01 |
|                      |  | (46,451) |        | (52,794) |        | (51,620) |        | (53,583) |        | (54,706) |       |
| 171–174              |  | 50.8     |        | 53.1*    |        | 50.8*    |        | 51.5     |        | 51.7*    |       |
|                      |  | (45,261) |        | (51,679) |        | (51,521) |        | (51,261) |        | (51,968) |       |
| 175–178              |  | 51.2*    |        | 53.1*    |        | 50.4     |        | 51.3     |        | 51.0     |       |
|                      |  | (40,815) |        | (45,727) |        | (45,639) |        | (44,744) |        | (34,658) |       |
| ≥179                 |  | 51.2*    |        | 53.2*    |        | 50.2     |        | 50.9     |        | 51.3     |       |
|                      |  | (34,510) |        | (38,561) |        | (38,711) |        | (37,062) |        | (46,565) |       |
| Weight (kg) ≤60      |  | 51.6*    | <0.001 | 53.7*    | <0.001 | 51.9*    | <0.001 | 53.0*    | <0.001 | 53.4*    |       |
|                      |  | (46,788) |        | (52,738) |        | (53,498) |        | (54,625) |        | (55,096) |       |
| 61–66                |  | 50.9*    |        | 53.3*    |        | 50.7*    |        | 51.5*    |        | 51.3     |       |
|                      |  | (38,399) |        | (43,828) |        | (43,117) |        | (42,099) |        | (41,226) |       |
| 67–75                |  | 50.5     |        | 52.8     |        | 50.2     |        | 50.3     |        | 50.6     |       |
|                      |  | (43,790) |        | (49,576) |        | (48,575) |        | (47,370) |        | (46,918) |       |
| ≥76                  |  | 50.1     |        | 52.0     |        | 49.3     |        | 50.0     |        | 50.4     |       |
|                      |  | (38,060) |        | (42,619) |        | (42,301) |        | (42,556) |        | (44,657) |       |
| BMI <18.5            |  | 52.7*    | <0.001 | 54.9*    | <0.001 | 53.6*    | <0.001 | 55.1*    | <0.001 | 55.6*    |       |
| (kg/m <sup>2</sup> ) |  | (17,267) |        | (19,321) |        | (19,979) |        | (20,625) |        | (21,357) |       |
| 18.5–22.99           |  | 50.9*    |        | 53.1*    |        | 50.6*    |        | 51.3*    |        | 51.4     |       |

|             |          |          |          |          |          |
|-------------|----------|----------|----------|----------|----------|
|             | (87,116) | (99,177) | (98,570) | (96,242) | (94,255) |
| 23.00–24.99 | 50.4     | 52.5     | 49.8     | 50.2     | 50.6     |
|             | (27,200) | (30,583) | (29,780) | (29,880) | (61,673) |
| ≥25.0       | 50.1     | 52.1     | 49.7     | 50.2     | 50.4     |
|             | (35,454) | (39,680) | (39,162) | (39,903) | (10,612) |

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BMI = body mass index.

\* Statistically significant.

\*\* Analysed by Pearson's significance ratio.

**Supplementary Table S3.** Multivariable Logistic Regression for the Identification of Myopia Risk Factors (birth season, education level, height, and weight) and Univariate Logistic Regression for BMI

| Risk factor     |                                           | Multivariable (myopia) |                      |                      |                      |                      |
|-----------------|-------------------------------------------|------------------------|----------------------|----------------------|----------------------|----------------------|
|                 |                                           | 2009                   | 2010                 | 2011                 | 2012                 | 2013                 |
|                 |                                           | OR (95% CI)            | OR (95% CI)          | OR (95% CI)          | OR (95% CI)          | OR (95% CI)          |
| Birth season    | Spring                                    | ref*                   | ref*                 | ref*                 | ref*                 | ref*                 |
|                 | Summer                                    | 1.003 (0.983–1.024)    | 0.949 (0.931–0.968)* | 0.975 (0.957–0.994)* | 0.973 (0.954–0.991)* | 0.983 (0.965–1.002)  |
|                 | Autumn                                    | 0.952 (0.933–0.971)*   | 0.952 (0.934–0.970)* | 0.936 (0.919–0.954)* | 0.972 (0.954–0.990)* | 0.973 (0.955–0.991)* |
|                 | Winter                                    | 0.986 (0.967–1.005)    | 0.917 (0.900–0.934)* | 0.927 (0.910–0.944)* | 0.937 (0.921–0.955)* | 0.950 (0.933–0.967)* |
| Education level | High school education or less             | ref*                   | ref*                 | ref*                 | ref*                 | ref*                 |
|                 | 2- to 3-year college education            | 0.738 (0.724–0.752)*   | 0.713 (0.700–0.727)* | 0.818 (0.804–0.832)* | 0.865 (0.850–0.881)* | 0.897 (0.881–0.913)* |
|                 | 4- or 6-year university education or more | 1.484 (1.459–1.509)*   | 1.331 (1.310–1.352)* | 1.514 (1.492–1.538)* | 1.509 (1.487–1.532)* | 1.459 (1.438–1.481)* |
|                 |                                           |                        |                      |                      |                      |                      |
| Height (cm)     | ≤170                                      | ref*                   | ref*                 | ref                  | ref*                 | ref*                 |
|                 | 171–174                                   | 1.017 (0.998–1.037)    | 1.025 (1.007–1.044)* | 1.015 (0.997–1.033)  | 1.022 (1.004–1.040)* | 1.017 (0.999–1.035)  |
|                 | 175–178                                   | 1.045 (1.024–1.066)*   | 1.036 (1.016–1.055)* | 1.005 (0.987–1.024)  | 1.029 (1.010–1.048)* | 0.999 (0.980–1.019)  |
|                 | ≥179                                      | 1.051 (1.029–1.074)*   | 1.044 (1.023–1.066)* | 1.008 (0.988–1.028)  | 1.026 (1.005–1.047)* | 1.025 (1.006–1.045)* |
| Weight (kg)     | ≤60                                       | ref*                   | ref*                 | ref*                 | ref*                 | ref*                 |
|                 |                                           |                        |                      |                      |                      |                      |

|                                |                      |                      |                      |                      |                      |
|--------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| 61–66                          | 0.934 (0.916–0.953)* | 0.953 (0.935–0.972)* | 0.926 (0.909–0.944)* | 0.914 (0.897–0.931)* | 0.897 (0.901–0.935)* |
| 67–75                          | 0.911 (0.893–0.929)* | 0.924 (0.906–0.941)* | 0.902 (0.886–0.919)* | 0.868 (0.852–0.884)* | 0.867 (0.876–0.907)* |
| ≥76                            | 0.911 (0.892–0.930)* | 0.911 (0.893–0.930)* | 0.893 (0.876–0.910)* | 0.873 (0.856–0.890)* | 0.875 (0.868–0.900)* |
| BMI (kg/m <sup>2</sup> ) <18.5 | ref*                 | ref*                 | ref*                 | ref*                 | ref*                 |
| 18.5–22.99                     | 0.928 (0.906–0.950)* | 0.931 (0.910–0.953)* | 0.885 (0.865–0.905)* | 0.858 (0.839–0.878)* | 0.846 (0.827–0.865)* |
| 23.00–24.99                    | 0.912 (0.888–0.938)* | 0.906 (0.882–0.930)* | 0.859 (0.837–0.881)* | 0.823 (0.802–0.844)* | 0.818 (0.797–0.839)* |
| ≥25.0                          | 0.902 (0.787–0.926)* | 0.893 (0.870–0.916)* | 0.854 (0.833–0.875)* | 0.820 (0.800–0.841)* | 0.817 (0.798–0.837)* |

BMI = body mass index; CI = confidence interval; OR = odds ratio; ref = reference for OR calculation.

\*Statistically significant.

**Supplementary Table S4.** Prevalence of High Myopia According to Possible Risk Factors

| Risk factor     |                                           | Prevalence of high myopia (%) |                   |          |                   |          |                   |          |                   |          |                   |
|-----------------|-------------------------------------------|-------------------------------|-------------------|----------|-------------------|----------|-------------------|----------|-------------------|----------|-------------------|
|                 |                                           | 2009                          |                   | 2010     |                   | 2011     |                   | 2012     |                   | 2013     |                   |
|                 |                                           | % (n)                         | <i>P</i> -value** | % (n)    | <i>P</i> -value** | % (n)    | <i>P</i> -value** | % (n)    | <i>P</i> -value** | % (n)    | <i>P</i> -value** |
| Birth season    | Spring                                    | 11.5*                         | <0.001            | 12.2*    | <0.05             | 12.1*    | <0.001            | 12.8*    | <0.05             | 13.2*    | <0.05             |
|                 |                                           | (8,638)                       |                   | (9,914)  |                   | (10,618) |                   | (11,649) |                   | (12,213) |                   |
|                 | Summer                                    | 11.5*                         |                   | 11.8     |                   | 11.7*    |                   | 12.6*    |                   | 13.0*    |                   |
|                 |                                           | (8,783)                       |                   | (9,665)  |                   | (10,097) |                   | (10,746) |                   | (11,163) |                   |
|                 | Autumn                                    | 10.8                          |                   | 11.7     |                   | 11.4     |                   | 12.7*    |                   | 12.8     |                   |
|                 |                                           | (8,490)                       |                   | (10,646) |                   | (10,714) |                   | (11,243) |                   | (11,556) |                   |
|                 | Winter                                    | 11.4*                         |                   | 11.8     |                   | 11.6     |                   | 12.3     |                   | 12.8     |                   |
|                 |                                           | (11,206)                      |                   | (11,951) |                   | (11,994) |                   | (12,202) |                   | (12,292) |                   |
| Education level | High school education or less             | 10.6                          | <0.001            | 13.9     | <0.001            | 10.8     | <0.001            | 11.6     | <0.001            | 11.9     | <0.001            |
|                 |                                           | (9,148)                       |                   | (11,789) |                   | (12,831) |                   | (14,992) |                   | (16,485) |                   |
|                 | 2- to 3-year college education            | 7.6                           |                   | 8.1      |                   | 8.5      |                   | 9.5      |                   | 10.3     |                   |
|                 |                                           | (6,076)                       |                   | (6,994)  |                   | (7,616)  |                   | (7,821)  |                   | (7,844)  |                   |
|                 | 4- or 6-year university education or more | 13.5*                         |                   | 11.5*    |                   | 14.1*    |                   | 15.1*    |                   | 15.3*    |                   |
|                 |                                           | (21,893)                      |                   | (23,393) |                   | (22,976) |                   | (23,027) |                   | (22,895) |                   |



|             |                  |                  |                  |                   |                  |
|-------------|------------------|------------------|------------------|-------------------|------------------|
| 18.5–22.99  | 11.1<br>(19,065) | 11.6<br>(21,698) | 11.6<br>(22,552) | 12.4<br>(23,183)  | 12.6<br>(23,125) |
| 23.00–24.99 | 11.3*<br>(6,103) | 11.8<br>(6,853)  | 11.6<br>(6,938)  | 12.4<br>(7,370)   | 13.0<br>(15,819) |
| ≥25.0       | 11.4*<br>(8,042) | 12.1*<br>(9,206) | 11.6<br>(9,164)  | 12.7*<br>(10,103) | 13.5*<br>(2,833) |

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BMI = body mass index.

\* Statistically significant.

\*\* Analysed with Pearson's significance ratio.

**Supplementary Table S5.** Multivariable Logistic Regression for the Identification of High Myopia Risk Factors (birth season, education level, height, and weight) and Univariate Logistic Regression for BMI

| Risk factor     |                                           | Multivariable (high myopia) |                      |                      |                      |                      |
|-----------------|-------------------------------------------|-----------------------------|----------------------|----------------------|----------------------|----------------------|
|                 |                                           | 2009                        | 2010                 | 2011                 | 2012                 | 2013                 |
|                 |                                           | OR (95% CI)                 | OR (95% CI)          | OR (95% CI)          | OR (95% CI)          | OR (95% CI)          |
| Birth season    | Spring                                    | ref*                        | ref*                 | ref*                 | ref*                 | ref*                 |
|                 | Summer                                    | 0.996 (0.965–1.028)         | 0.968 (0.940–0.998)* | 0.967 (0.939–0.996)* | 0.988 (0.961–1.016)  | 0.986 (0.959–1.014)  |
|                 | Autumn                                    | 0.928 (0.899–0.958)*        | 0.958 (0.931–0.987)* | 0.939 (0.913–0.966)* | 0.994 (0.966–1.022)  | 0.970 (0.944–0.997)* |
|                 | Winter                                    | 0.983 (0.954–1.013)         | 0.966 (0.939–0.994)* | 0.944 (0.918–0.971)* | 0.951 (0.926–0.978)* | 0.955 (0.930–0.981)* |
| Education level | High school education or less             | ref*                        | ref*                 | ref*                 | ref*                 | ref*                 |
|                 | 2- to 3-year college education            | 0.696 (0.673–0.720)*        | 0.681 (0.660–0.703)* | 0.764 (0.741–0.787)* | 0.805 (0.780–0.829)* | 0.853 (0.829–0.878)* |
|                 | 4- or 6-year university education or more | 1.318 (1.284–1.353)*        | 1.245 (1.215–1.275)* | 1.361 (1.329–1.392)* | 1.362 (1.332–1.392)* | 1.353 (1.324–1.383)* |
|                 |                                           |                             |                      |                      |                      |                      |
| Height (cm)     | ≤170                                      | ref*                        | ref*                 | ref*                 | ref*                 | ref*                 |
|                 | 171–174                                   | 0.984 (0.964–1.022)         | 1.033 (1.005–1.063)* | 1.022 (0.995–1.051)  | 1.032 (1.004–1.060)* | 1.031 (1.005–1.059)* |
|                 | 175–178                                   | 1.026 (0.995–1.059)         | 1.053 (1.023–1.085)* | 1.039 (1.009–1.070)* | 1.058 (1.028–1.088)* | 1.059 (1.028–1.091)* |
|                 | ≥179                                      | 1.055 (1.020–1.091)*        | 1.087 (1.053–1.122)* | 1.080 (1.047–1.114)* | 1.100 (1.067–1.133)* | 1.080 (1.050–1.111)* |
| Weight (kg)     | ≤60                                       | ref*                        | ref*                 | ref*                 | ref*                 | ref*                 |

|                          |             |                      |                      |                      |                      |                      |
|--------------------------|-------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|                          | 61–66       | 0.949 (0.920–0.979)* | 0.960 (0.932–0.989)* | 0.931 (0.905–0.958)* | 0.917 (0.892–0.944)* | 0.934 (0.908–0.961)* |
|                          | 67–75       | 0.963 (0.934–0.993)* | 0.945 (0.918–0.973)* | 0.927 (0.901–0.954)* | 0.902 (0.877–0.927)* | 0.923 (0.898–0.949)* |
|                          | ≥76         | 0.985 (0.954–1.018)  | 0.991 (0.962–1.022)  | 0.951 (0.923–0.980)* | 0.961 (0.933–0.989)* | 0.993 (0.966–1.022)  |
| BMI (kg/m <sup>2</sup> ) | <18.5       | ref*                 | ref*                 | ref*                 | ref*                 | ref*                 |
|                          | 18.5–22.99  | 0.925 (0.891–0.959)* | 0.916 (0.885–0.948)* | 0.891 (0.862–0.922)* | 0.877 (0.849–0.906)* | 0.874 (0.847–0.902)* |
|                          | 23.00–24.99 | 0.942 (0.903–0.983)* | 0.927 (0.890–0.965)* | 0.894 (0.860–0.930)* | 0.880 (0.847–0.914)* | 0.880 (0.848–0.914)* |
|                          | ≥25.0       | 0.947 (0.910–0.987)* | 0.957 (0.921–0.994)* | 0.896 (0.863–0.930)* | 0.905 (0.873–0.938)* | 0.928 (0.897–0.961)* |

BMI = body mass index; CI = confidence interval; OR = odds ratio; ref = reference for OR calculation.

\* Statistically significant.