Supporting information for

Morning chronotype and digestive tract cancers: Mendelian randomization study

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Table of Contents

Supplementary Table 1. Diagnostic information of cancer in UK Biobank 2
Supplementary Table 2. Diagnostic information of cancer in FinnGen 3
Supplementary Table 3. Genetic instrumental variables used for genetic liability to chronotype 4
Supplementary Table 4. Results of multiple testing correction for combined associations by the false discovery rate (FDR) method 13
Supplementary Table 5. Associations between genetic liability to chronotype and cancers of digestive tract, stomach, and colorectum in the analysis where the exposure data were obtained from 23andMe 14
Supplementary Table 1. Diagnostic information of cancer in UK Biobank

| Cancer site/cancer   | Diagnostic information                  | ICD-9 codes          | ICD-10 codes          | Self-reported cancer |
|----------------------|-----------------------------------------|----------------------|-----------------------|----------------------|
| Digestive system cancer | 150, V10.03, 151, V10.04, 157, 155, 156, 153, 154.0, 154.1, V10.05, V10.06 | C15, Z85.01, C16, Z85.028, C25, Z85.07, C22.0, C22.1, C23.X, C24.X, C18, C19, C20, Z85.038, Z85.048 | 1017, 1018, 1034, 1024, 1025, 1020, 1022, 1023 |
| Esophagus            | 150, V10.03                            | C15, Z85.01          | 1017                  |
| Stomach              | 151, V10.04                            | C16, Z85.028         | 1018                  |
| Liver                | 155                                    | C22.0                | 1024                  |
| Biliary tract        | 155.1, 156.0                           | C22.1, C23.X, C24.X  | 1025                  |
| Pancreas             | 157                                    | C25, Z85.07          | 1034                  |
| Colorectum           | 153, 154.0, 154.1, V10.05, V10.06      | C18, C19, C20, Z85.038, Z85.048 | 1020, 1022, 1023 |

ICD, International Classification of Diseases.
Supplementary Table 2. Diagnostic information of cancer in FinnGen

| Cancer site/cancer     | Diagnostic information | ICD-8 codes | ICD-9 codes | ICD-10 codes |
|------------------------|------------------------|-------------|-------------|--------------|
| Digestive system cancer|                        | 150, 151, 152, 153, 1540, 1541, 1542, 155, 156, 157, 158, 159 | 150, 151, 152, 153, 154, 155, 156, 157, 158, 159 | C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26 |
| Esophagus              |                        | 150         | 150         | C15          |
| Stomach                |                        | 151         | 151         | C16          |
| Liver                  |                        | 155         | 155         | C22          |
| Biliary tract          |                        | 156         | 156         | C24          |
| Pancreas               |                        | 157         | 157         | C25          |
| Colorectum             |                        | 153, 1540, 1541 | 153, 154 | C18, C19, C20 |

ICD, International Classification of Diseases.
### Supplementary Table 3. Genetic instrumental variables used for genetic liability to chronotype

| SNP      | Chr | Position  | EA | EAF | Beta_meta | SE_meta | Beta_23 | SE_23 |
|----------|-----|-----------|----|-----|-----------|---------|---------|-------|
| rs10916892 | 1   | 21201325  | T  | 0.62 | -0.035    | 0.004   | -0.036  | 0.006 |
| rs11102807 | 1   | 115061584 | A  | 0.54 | -0.022    | 0.004   | -0.019  | 0.006 |
| rs11165655 | 1   | 96959104  | A  | 0.53 | -0.028    | 0.004   | -0.029  | 0.006 |
| rs11208844 | 1   | 66851147  | A  | 0.14 | -0.029    | 0.005   | -0.032  | 0.008 |
| rs1144566  | 1   | 182569626 | T  | 0.03 | 0.231     | 0.010   | 0.312   | 0.018 |
| rs115073088| 1   | 174215858 | A  | 0.98 | -0.076    | 0.011   | -0.077  | 0.018 |
| rs11588913 | 1   | 79963816  | A  | 0.40 | -0.024    | 0.004   | -0.021  | 0.006 |
| rs12040629 | 1   | 77705365  | A  | 0.16 | 0.073     | 0.005   | 0.083   | 0.008 |
| rs12065331 | 1   | 14507831  | T  | 0.31 | -0.024    | 0.004   | -0.030  | 0.007 |
| rs12140153 | 1   | 62579891  | T  | 0.09 | -0.060    | 0.007   | -0.068  | 0.012 |
| rs1221502  | 1   | 193276975 | A  | 0.74 | 0.020     | 0.003   | 0.023   | 0.007 |
| rs17448682 | 1   | 15966713  | T  | 0.23 | 0.035     | 0.004   | 0.035   | 0.007 |
| rs1757598  | 1   | 110086451 | A  | 0.19 | -0.034    | 0.004   | -0.034  | 0.008 |
| rs4657983  | 1   | 195454557 | A  | 0.65 | -0.025    | 0.004   | -0.031  | 0.006 |
| rs481214   | 1   | 93469865  | A  | 0.61 | 0.023     | 0.004   | 0.020   | 0.006 |
| rs5016898  | 1   | 81672013  | T  | 0.42 | -0.024    | 0.004   | -0.029  | 0.006 |
| rs61773390 | 1   | 7884525   | T  | 0.19 | 0.066     | 0.005   | 0.077   | 0.008 |
| rs6429233  | 1   | 24113703  | A  | 0.46 | 0.020     | 0.003   | 0.022   | 0.006 |
| rs6665637  | 1   | 153756083 | A  | 0.28 | -0.020    | 0.003   | -0.027  | 0.007 |
| rs6690292  | 1   | 113188419 | T  | 0.73 | -0.025    | 0.004   | -0.025  | 0.007 |
| rs72720396 | 1   | 91191582  | A  | 0.77 | -0.042    | 0.004   | -0.037  | 0.007 |
| rs9436119  | 1   | 150467753 | A  | 0.38 | 0.040     | 0.003   | 0.053   | 0.006 |
| rs975025   | 1   | 179338327 | T  | 0.08 | -0.049    | 0.006   | -0.052  | 0.011 |
| rs10175975 | 2   | 59429807  | T  | 0.19 | 0.025     | 0.004   | 0.016   | 0.008 |
| rs10520176 | 2   | 77217310  | T  | 0.49 | 0.038     | 0.004   | 0.039   | 0.006 |
| rs1064213  | 2   | 198950240 | A  | 0.48 | 0.044     | 0.004   | 0.065   | 0.006 |
| rs113851554| 2   | 66750564  | T  | 0.06 | -0.054    | 0.007   | -0.067  | 0.014 |
| rs11677484 | 2   | 191578172 | T  | 0.26 | 0.023     | 0.004   | 0.018   | 0.007 |
| rs11678584 | 2   | 32563426  | A  | 0.86 | -0.028    | 0.005   | -0.041  | 0.009 |
| rs11681299 | 2   | 88901732  | T  | 0.28 | 0.024     | 0.004   | 0.035   | 0.007 |
| rs12464387 | 2   | 75445544  | A  | 0.46 | -0.021    | 0.003   | -0.024  | 0.006 |
| rs12470914 | 2   | 50532840  | A  | 0.10 | 0.053     | 0.006   | 0.069   | 0.010 |
| rs13004345 | 2   | 174037347 | T  | 0.65 | -0.019    | 0.003   | -0.025  | 0.006 |
| rs13011556 | 2   | 4651923   | C  | 0.76 | -0.029    | 0.004   | -0.025  | 0.007 |
| rs13414393 | 2   | 54275162  | T  | 0.54 | -0.022    | 0.004   | -0.021  | 0.006 |
| rs17396357 | 2   | 48252311  | T  | 0.38 | 0.021     | 0.004   | 0.032   | 0.006 |
| rs184033703| 2    | 206956138 | A  | 0.06 | 0.058     | 0.008   | 0.054   | 0.013 |
| rs           | Ch   | Position   | Allele | p-value | MAF 1 | MAF 2 | MAF 3 | MAF 4 |
|--------------|------|------------|--------|---------|-------|-------|-------|-------|
| rs2166559    | 2    | 149551658  | T      | 0.86    | -0.033| 0.005 | -0.025| 0.009 |
| rs2706762    | 2    | 70488470   | T      | 0.15    | -0.037| 0.005 | -0.045| 0.008 |
| rs28380327   | 2    | 144232491  | A      | 0.63    | 0.040 | 0.004 | 0.052 | 0.006 |
| rs34509802   | 2    | 101591710  | A      | 0.18    | 0.040 | 0.005 | 0.051 | 0.008 |
| rs359248     | 2    | 60477461   | T      | 0.46    | -0.028| 0.003 | -0.038| 0.006 |
| rs4666682    | 2    | 186203743  | A      | 0.18    | -0.025| 0.004 | -0.029| 0.008 |
| rs4672458    | 2    | 53736362   | T      | 0.48    | -0.022| 0.003 | -0.018| 0.006 |
| rs62124718   | 2    | 12829995   | A      | 0.90    | -0.045| 0.006 | -0.057| 0.010 |
| rs62182135   | 2    | 240267305  | A      | 0.33    | -0.024| 0.003 | -0.026| 0.006 |
| rs6433478    | 2    | 175241482  | T      | 0.46    | -0.025| 0.004 | -0.035| 0.006 |
| rs6544906    | 2    | 46863872   | A      | 0.56    | 0.023 | 0.004 | 0.030 | 0.006 |
| rs6727752    | 2    | 76361783   | A      | 0.36    | 0.026 | 0.004 | 0.023 | 0.007 |
| rs72796401   | 2    | 24180078   | A      | 0.19    | 0.025 | 0.003 | 0.029 | 0.008 |
| rs747003     | 2    | 161916409  | T      | 0.61    | 0.020 | 0.003 | 0.017 | 0.006 |
| rs75120545   | 2    | 44271464   | T      | 0.03    | 0.086 | 0.010 | 0.085 | 0.018 |
| rs76064513   | 2    | 125438641  | T      | 0.13    | 0.034 | 0.006 | 0.042 | 0.009 |
| rs77248969   | 2    | 136490731  | A      | 0.11    | -0.033| 0.006 | -0.034| 0.009 |
| rs80271258   | 2    | 239311505  | T      | 0.08    | -0.089| 0.006 | -0.096| 0.011 |
| rs812925     | 2    | 61680993   | C      | 0.65    | -0.031| 0.004 | -0.031| 0.006 |
| rs848552     | 2    | 36700580   | C      | 0.48    | -0.028| 0.004 | -0.033| 0.006 |
| rs111261826  | 3    | 7189617    | A      | 0.68    | -0.028| 0.004 | -0.031| 0.006 |
| rs111867612  | 3    | 157721819  | A      | 0.10    | -0.032| 0.006 | -0.033| 0.010 |
| rs112201801  | 3    | 82591379   | T      | 0.93    | -0.085| 0.013 | -0.085| 0.013 |
| rs114848860  | 3    | 36859494   | A      | 0.97    | -0.077| 0.010 | -0.095| 0.021 |
| rs12636669   | 3    | 50003323   | T      | 0.08    | 0.057 | 0.006 | 0.071 | 0.011 |
| rs13065394   | 3    | 132971327  | T      | 0.29    | -0.027| 0.004 | -0.024| 0.007 |
| rs1398346    | 3    | 110271943  | T      | 0.87    | 0.026 | 0.005 | 0.032 | 0.009 |
| rs1449043    | 3    | 85591467   | A      | 0.12    | 0.042 | 0.006 | 0.055 | 0.009 |
| rs1468945    | 3    | 18590392   | A      | 0.79    | -0.036| 0.004 | -0.035| 0.007 |
| rs149611468  | 3    | 8817423    | T      | 0.99    | 0.143 | 0.018 | 0.174 | 0.032 |
| rs1589374    | 3    | 160891727  | A      | 0.52    | 0.031 | 0.004 | 0.037 | 0.006 |
| rs1707397    | 3    | 70594975   | C      | 0.58    | 0.023 | 0.004 | 0.026 | 0.006 |
| rs1800828    | 3    | 113891549  | C      | 0.75    | 0.026 | 0.004 | 0.016 | 0.007 |
| rs2362775    | 3    | 24924421   | T      | 0.53    | -0.022| 0.004 | -0.008| 0.006 |
| rs301218     | 3    | 176096919  | A      | 0.39    | -0.024| 0.004 | -0.032| 0.006 |
| rs34967119   | 3    | 104778430  | A      | 0.50    | 0.020 | 0.003 | 0.023 | 0.006 |
| rs35346733   | 3    | 2521322    | A      | 0.19    | -0.032| 0.005 | -0.032| 0.008 |
| rs3850174    | 3    | 172364093  | A      | 0.26    | -0.035| 0.004 | -0.039| 0.007 |
| rs6440833    | 3    | 152646244  | A      | 0.46    | 0.021 | 0.003 | 0.029 | 0.006 |
| rs72950188   | 3    | 116103275  | T      | 0.92    | 0.045 | 0.007 | 0.053 | 0.011 |
| SNP          | CHROM | POS   | REF  | ALT  | MAF  | BETA  | P    |
|--------------|-------|-------|------|------|------|-------|------|
| rs7296564    | 3     | 123149816 | T   | 0.25 | -0.023 | 0.004 | -0.019 |
| rs73050286   | 3     | 23224684  | T   | 0.78 | 0.030 | 0.004 | 0.030  |
| rs7429614    | 3     | 77205438  | T   | 0.42 | 0.035  | 0.004 | 0.046  |
| rs7626335    | 3     | 71575177  | A   | 0.33 | -0.029 | 0.004 | -0.041  |
| rs7649164    | 3     | 150788032 | T   | 0.57 | 0.021  | 0.004 | 0.024   |
| rs9817910    | 3     | 18246870  | A   | 0.56 | -0.022 | 0.003 | -0.016  |
| rs9836621    | 3     | 182096311 | T   | 0.52 | -0.028 | 0.004 | -0.040  |
| rs1502249    | 4     | 27495379  | A   | 0.52 | 0.017  | 0.003 | 0.022   |
| rs17455138   | 4     | 130903511 | T   | 0.77 | 0.031  | 0.005 | 0.041   |
| rs2850979    | 4     | 102094764 | T   | 0.76 | -0.023 | 0.004 | -0.022  |
| rs3796618    | 4     | 1349602   | A   | 0.53 | -0.023 | 0.004 | -0.020  |
| rs4241964    | 4     | 137053959 | T   | 0.52 | -0.029 | 0.003 | -0.023  |
| rs4690085    | 4     | 2697300   | A   | 0.53 | -0.019 | 0.003 | -0.015  |
| rs4698678    | 4     | 18260776  | C   | 0.28 | 0.031  | 0.004 | 0.038   |
| rs4860734    | 4     | 67096904  | A   | 0.29 | 0.020  | 0.003 | 0.024   |
| rs6816922    | 4     | 80206272  | A   | 0.54 | -0.020 | 0.004 | -0.022  |
| rs6838677    | 4     | 66520667  | A   | 0.67 | -0.021 | 0.004 | -0.022  |
| rs6846730    | 4     | 83279041  | T   | 0.24 | -0.032 | 0.004 | -0.029  |
| rs72729847   | 4     | 147296930 | T   | 0.80 | -0.030 | 0.005 | -0.036  |
| rs7700110    | 4     | 114439894 | A   | 0.26 | 0.024  | 0.004 | 0.030   |
| rs938836     | 4     | 139939653 | A   | 0.47 | -0.021 | 0.003 | -0.027  |
| rs9991917    | 4     | 132512118 | A   | 0.19 | 0.045  | 0.008 | 0.045   |
| rs9997394    | 4     | 163704083 | A   | 0.29 | -0.025 | 0.004 | -0.031  |
| rs10058356   | 5     | 35220404  | T   | 0.70 | -0.021 | 0.003 | -0.018  |
| rs12518401   | 5     | 173539588 | A   | 0.38 | -0.024 | 0.004 | -0.034  |
| rs13172141   | 5     | 122990902 | A   | 0.57 | 0.022  | 0.004 | 0.028   |
| rs1559253    | 5     | 106657015 | A   | 0.36 | 0.022  | 0.004 | 0.036   |
| rs2901796    | 5     | 163330708 | A   | 0.40 | 0.025  | 0.004 | 0.026   |
| rs42210      | 5     | 166408788 | C   | 0.71 | -0.029 | 0.005 | -0.031  |
| rs4269995    | 5     | 87701223  | T   | 0.25 | -0.034 | 0.004 | -0.047  |
| rs465670     | 5     | 176877624 | T   | 0.54 | 0.024  | 0.004 | 0.023   |
| rs67988891   | 5     | 152204741 | C   | 0.68 | -0.036 | 0.004 | -0.031  |
| rs7701529    | 5     | 63861475  | A   | 0.24 | -0.030 | 0.004 | -0.029  |
| rs7721608    | 5     | 76581258  | T   | 0.46 | 0.020  | 0.003 | 0.030   |
| rs7735794    | 5     | 175339984 | A   | 0.22 | 0.034  | 0.006 | NA     |
| rs77960      | 5     | 103964585 | A   | 0.33 | 0.022  | 0.003 | 0.016   |
| rs11154718   | 6     | 99592404  | T   | 0.43 | -0.023 | 0.004 | -0.027  |
| rs12195792   | 6     | 98705295  | A   | 0.27 | 0.034  | 0.004 | 0.047   |
| rs12206814   | 6     | 41517457  | C   | 0.49 | 0.025  | 0.004 | 0.017   |
| rs1811899    | 6     | 14878060  | T   | 0.79 | -0.030 | 0.005 | -0.037  |
| SNP       | chrom | start   | allele | minor_allele_freq. | freq | SNP       | chrom | start   | allele | minor_allele_freq. | freq |
|-----------|-------|---------|--------|-------------------|------|-----------|-------|---------|--------|-------------------|------|
| rs1931814 | 6     | 62589167| A      | 0.48              | 0.026| rs2050185 | 6     | 147936781| A      | 0.62              | 0.022| rs2396004 | 6     | 43355851  | A     | 0.44              | 0.021| rs2653349 | 6     | 55142337  | A     | 0.21              | 0.066| rs2881955 | 6     | 72479263  | T     | 0.28              | 0.027| rs3857599 | 6     | 50938247  | A     | 0.17              | 0.032| rs3923809 | 6     | 38440970  | A     | 0.69              | -0.022| rs4535583 | 6     | 115699280| T     | 0.70              | 0.021| rs486416  | 6     | 31856070  | A     | 0.65              | -0.020| rs60616179 | 6    | 110244765| A     | 0.94              | 0.051| rs766406  | 6     | 26319588  | T     | 0.64              | -0.024| rs9347926 | 6     | 165195547| A     | 0.44              | 0.026| rs9348050 | 6     | 166263488| T     | 0.49              | 0.022| rs9381812 | 6     | 13183998  | A     | 0.71              | -0.050| rs9394154 | 6     | 11574374  | C     | 0.44              | -0.022| rs9465253 | 6     | 19102247  | T     | 0.28              | 0.023| rs9479402 | 6     | 153135339| T     | 0.99              | -0.219| rs9496623 | 6     | 143751625| A     | 0.73              | -0.024| rs10237162 | 7    | 24085405  | T     | 0.72              | 0.037| rs10254050 | 7    | 96468077  | C     | 0.19              | -0.058| rs10951325 | 7    | 32265545  | T     | 0.63              | 0.034| rs113161209| 7   | 148564367| A     | 0.08              | 0.044| rs17302081 | 7    | 115673079| T     | 0.44              | 0.022| rs2072413 | 7     | 150647969| T     | 0.26              | -0.021| rs2944831 | 7     | 71779635  | A     | 0.29              | 0.025| rs3807651 | 7     | 77823771  | A     | 0.49              | 0.025| rs4027217 | 7     | 14093914  | A     | 0.22              | -0.026| rs4236237 | 7     | 69936477  | A     | 0.60              | -0.024| rs4729854 | 7     | 102383663| A     | 0.47              | -0.049| rs62465218 | 7    | 132294312| A     | 0.15              | -0.027| rs6958557 | 7     | 133585794| T     | 0.61              | 0.026| rs6967481 | 7     | 50642701  | T     | 0.50              | 0.032| rs6968240 | 7     | 121942674| A     | 0.42              | 0.022| rs10109566 | 8   | 59800446  | A     | 0.48              | -0.022| rs16939162 | 8   | 76653156  | A     | 0.83              | 0.038| rs187028  | 8     | 73459513  | A     | 0.31              | -0.022| rs1871729 | 8     | 136223702| A     | 0.68              | -0.023| rs2322605 | 8     | 27164449  | A     | 0.47              | -0.022| rs2737245 | 8     | 116658583| T     | 0.27              | 0.034| rs2979139 | 8     | 8268313   | A     | 0.50              | -0.027|
| SNP         | Chromosome | Position (bp) | Allele | Minor Allele Frequency | Major Allele Frequency | p-Value |
|-------------|------------|---------------|--------|------------------------|------------------------|---------|
| rs3100052   | 8          | 101967139     | A      | 0.39                   | 0.025                  | 0.004   |
| rs34054660  | 8          | 65015659      | A      | 0.57                   | 0.025                  | 0.004   |
| rs35524253  | 8          | 4823608       | A      | 0.35                   | 0.034                  | 0.004   |
| rs62479736  | 8          | 3654320       | T      | 0.29                   | 0.024                  | 0.004   |
| rs6468316   | 8          | 35237788      | T      | 0.47                   | -0.020                 | 0.003   |
| rs6988733   | 8          | 91535686      | T      | 0.35                   | 0.023                  | 0.004   |
| rs6993892   | 8          | 33729200      | T      | 0.62                   | -0.035                 | 0.004   |
| rs7006885   | 8          | 93283578      | A      | 0.29                   | 0.030                  | 0.004   |
| rs71523448  | 8          | 31817493      | C      | 0.08                   | -0.050                 | 0.007   |
| rs7845620   | 8          | 53129069      | A      | 0.83                   | -0.043                 | 0.006   |
| rs10759208  | 9          | 109806199     | T      | 0.61                   | -0.025                 | 0.004   |
| rs10818834  | 9          | 126317324     | T      | 0.73                   | 0.030                  | 0.004   |
| rs10988239  | 9          | 131943440     | T      | 0.51                   | -0.021                 | 0.003   |
| rs11788633  | 9          | 116767656     | C      | 0.65                   | 0.020                  | 0.003   |
| rs12378543  | 9          | 83196097      | T      | 0.38                   | -0.023                 | 0.004   |
| rs12380242  | 9          | 139310187     | T      | 0.51                   | -0.021                 | 0.003   |
| rs2844016   | 9          | 24582747      | T      | 0.29                   | 0.027                  | 0.004   |
| rs295268    | 9          | 86429305      | T      | 0.74                   | -0.031                 | 0.005   |
| rs308521    | 9          | 37367094      | T      | 0.60                   | 0.028                  | 0.003   |
| rs3138490   | 9          | 92219000      | A      | 0.52                   | 0.024                  | 0.004   |
| rs4878734   | 9          | 38010885      | A      | 0.51                   | 0.022                  | 0.004   |
| rs555784    | 9          | 85318704      | A      | 0.38                   | -0.025                 | 0.004   |
| rs62553781  | 9          | 76679777      | T      | 0.03                   | -0.069                 | 0.009   |
| rs6477309   | 9          | 8450638       | T      | 0.67                   | 0.031                  | 0.004   |
| rs6560218   | 9          | 74245426      | T      | 0.52                   | -0.022                 | 0.004   |
| rs28458909  | 9          | 140257189     | T      | 0.12                   | -0.070                 | 0.006   |
| rs10762434  | 10         | 73044413      | C      | 0.78                   | 0.025                  | 0.004   |
| rs10830107  | 10         | 129304075     | A      | 0.79                   | 0.028                  | 0.005   |
| rs11200159  | 10         | 123553392     | A      | 0.66                   | -0.023                 | 0.004   |
| rs1163238   | 10         | 104943993     | A      | 0.39                   | -0.024                 | 0.004   |
| rs12249410  | 10         | 64301941      | T      | 0.11                   | -0.034                 | 0.006   |
| rs12771973  | 10         | 133749294     | A      | 0.25                   | -0.022                 | 0.004   |
| rs17712705  | 10         | 69623271      | A      | 0.33                   | -0.025                 | 0.004   |
| rs2298117   | 10         | 70346740      | T      | 0.45                   | -0.023                 | 0.004   |
| rs3808964   | 10         | 125426627     | T      | 0.63                   | 0.020                  | 0.003   |
| rs497338    | 10         | 804315        | T      | 0.29                   | 0.027                  | 0.004   |
| rs61875203  | 10         | 93888810      | T      | 0.28                   | 0.026                  | 0.004   |
| rs66617308  | 10         | 56699338      | T      | 0.67                   | 0.018                  | 0.003   |
| rs76518095  | 10         | 131149976     | T      | 0.08                   | 0.040                  | 0.007   |
| rs7900191   | 10         | 119145774     | T      | 0.40                   | -0.019                 | 0.003   |
| SNP          | Chromosome Position | Genotype | A1 Allele Frequency | A2 Allele Frequency |
|-------------|---------------------|----------|--------------------|--------------------|
| rs9416744   | 10                 | 60567937 | 0.26               | 0.034              |
| rs9664044   | 10                 | 126710791 | 0.23              | -0.027             |
| rs10742179  | 11                 | 27650524 | 0.26               | 0.035              |
| rs10832648  | 11                 | 16618307 | 0.20               | -0.031             |
| rs10838687  | 11                 | 475312892 | 0.79             | 0.035              |
| rs11032362  | 11                 | 33759092 | 0.09               | 0.070              |
| rs1278402   | 11                 | 82972097 | 0.74               | 0.028              |
| rs12808544  | 11                 | 58373221 | 0.24               | -0.035             |
| rs1508608   | 11                 | 92893825 | 0.32               | 0.028              |
| rs17577073  | 11                 | 99152801 | 0.56               | 0.025              |
| rs2514214   | 11                 | 113395329 | 0.27              | 0.027              |
| rs3867239   | 11                 | 122093090 | 0.38            | 0.026              |
| rs4121878   | 11                 | 95120372 | 0.50               | 0.022              |
| rs4923541   | 11                 | 28479535 | 0.51               | 0.025              |
| rs4936290   | 11                 | 114009255 | 0.66            | -0.023             |
| rs612421    | 11                 | 30405914 | 0.63               | -0.027             |
| rs662094    | 11                 | 66342691 | 0.49               | 0.028              |
| rs711582    | 11                 | 43893222 | 0.90               | -0.039             |
| rs74357745  | 11                 | 122811822 | 0.88          | 0.031              |
| rs7943634   | 11                 | 126734319 | 0.31             | -0.024             |
| rs10877962  | 12                 | 63520912 | 0.41               | 0.036              |
| rs11611435  | 12                 | 240893222 | 0.56            | 0.028              |
| rs12298405  | 12                 | 17015267 | 0.33               | -0.023             |
| rs1799464   | 12                 | 16286082 | 0.29               | -0.020             |
| rs1843888   | 12                 | 38737310 | 0.54               | 0.051              |
| rs2433634   | 12                 | 23060363 | 0.72               | -0.027             |
| rs247929    | 12                 | 46294908 | 0.51               | 0.031              |
| rs3782860   | 12                 | 361996 | 0.54               | 0.025              |
| rs3955311   | 12                 | 114343818 | 0.15           | 0.026              |
| rs711098    | 12                 | 77976559 | 0.40               | 0.022              |
| rs7298532   | 12                 | 112510404 | 0.72           | 0.027              |
| rs7299922   | 12                 | 54702519 | 0.64               | 0.024              |
| rs7304278   | 12                 | 106989915 | 0.28          | -0.029             |
| rs7959983   | 12                 | 90452978 | 0.60               | -0.030             |
| rs7975791   | 12                 | 49413486 | 0.04               | 0.051              |
| rs80097534  | 12                 | 121029604 | 0.10             | -0.036             |
| rs1163628   | 13                 | 112226420 | 0.86            | -0.029             |
| rs1886205   | 13                 | 94062095 | 0.76               | 0.029              |
| rs2593487   | 13                 | 69903058 | 0.34               | -0.029             |
| rs3815983   | 13                 | 109779906 | 0.36             | -0.022             |

9
| rs | 10   | 13        | 14        |
|----|------|-----------|-----------|
| rs45597035 | 13 | 73649152  | A | 0.65 | -0.022 | 0.004 | -0.023 | 0.006 |
| rs495593  | 13 | 72919800  | A | 0.74 | 0.023  | 0.004 | 0.032  | 0.007 |
| rs9558942 | 13 | 107700218 | T | 0.67 | -0.019 | 0.003 | -0.032 | 0.006 |
| rs9571526 | 13 | 66590868  | T | 0.77 | -0.027 | 0.005 | -0.032 | 0.007 |
| rs9573980 | 13 | 77590741  | A | 0.97 | 0.127  | 0.010 | 0.150  | 0.017 |
| rs9597241 | 13 | 56281271  | A | 0.81 | 0.033  | 0.004 | 0.037  | 0.008 |
| rs11845599| 14 | 101016824 | A | 0.64 | -0.027 | 0.004 | -0.034 | 0.006 |
| rs2878172 | 14 | 55373670  | A | 0.57 | -0.021 | 0.004 | -0.030 | 0.006 |
| rs2978382 | 14 | 64769074  | T | 0.59 | 0.023  | 0.004 | 0.021  | 0.006 |
| rs4550384 | 14 | 85350142  | T | 0.76 | 0.024  | 0.004 | 0.028  | 0.007 |
| rs4903203 | 14 | 74660508  | A | 0.32 | 0.025  | 0.004 | 0.027  | 0.006 |
| rs61990287| 14 | 42069889  | A | 0.27 | 0.025  | 0.004 | 0.027  | 0.007 |
| rs6573308 | 14 | 60806976  | T | 0.39 | 0.025  | 0.004 | 0.026  | 0.006 |
| rs710284  | 14 | 98532540  | T | 0.58 | 0.022  | 0.004 | 0.025  | 0.006 |
| rs7143933 | 14 | 62460219  | T | 0.26 | 0.025  | 0.004 | 0.034  | 0.007 |
| rs962961  | 14 | 57281154  | T | 0.33 | -0.022 | 0.003 | -0.025 | 0.006 |
| rs12442008| 15 | 53725112  | T | 0.26 | 0.029  | 0.004 | 0.035  | 0.007 |
| rs12442674| 15 | 96907819  | A | 0.73 | 0.023  | 0.004 | 0.040  | 0.008 |
| rs1873958 | 15 | 101147726 | A | 0.41 | 0.028  | 0.003 | 0.041  | 0.006 |
| rs4775086 | 15 | 58969292  | A | 0.24 | -0.027 | 0.005 | -0.030 | 0.007 |
| rs59986227| 15 | 48099263  | C | 0.75 | -0.031 | 0.004 | -0.029 | 0.007 |
| rs11641239| 16 | 23124193  | T | 0.29 | 0.023  | 0.004 | 0.017  | 0.007 |
| rs12445235| 16 | 8195278  | C | 0.41 | -0.021 | 0.004 | -0.024 | 0.006 |
| rs12927162| 16 | 52684916  | A | 0.73 | 0.056  | 0.004 | 0.066  | 0.007 |
| rs1421085 | 16 | 53800954  | T | 0.59 | -0.042 | 0.003 | -0.044 | 0.006 |
| rs17604349| 16 | 72210865  | A | 0.18 | -0.037 | 0.004 | -0.044 | 0.008 |
| rs2304467 | 16 | 8988777   | C | 0.61 | -0.024 | 0.004 | -0.020 | 0.006 |
| rs2550298 | 16 | 56367969  | T | 0.38 | -0.040 | 0.004 | -0.043 | 0.006 |
| rs4785296 | 16 | 49467234  | C | 0.23 | 0.026  | 0.004 | 0.029  | 0.007 |
| rs7203707 | 16 | 24518569  | A | 0.52 | -0.020 | 0.003 | -0.016 | 0.006 |
| rs72773411| 16 | 728514    | A | 0.15 | 0.029  | 0.005 | 0.035  | 0.009 |
| rs72790386| 16 | 68136932  | T | 0.03 | 0.060  | 0.011 | 0.071  | 0.017 |
| rs8044054 | 16 | 60628436  | T | 0.39 | 0.031  | 0.004 | 0.031  | 0.006 |
| rs1061032 | 17 | 8064083   | T | 0.09 | 0.064  | 0.006 | 0.065  | 0.010 |
| rs11545787| 17 | 17398278  | A | 0.25 | -0.050 | 0.004 | -0.070 | 0.007 |
| rs12051  | 17 | 46103760  | A | 0.61 | -0.026 | 0.004 | -0.033 | 0.006 |
| rs12600452| 17 | 45084564  | A | 0.20 | 0.026  | 0.004 | 0.034  | 0.008 |
| rs12950382| 17 | 30603994  | A | 0.72 | 0.023  | 0.004 | 0.027  | 0.007 |
| rs2011528 | 17 | 33980566  | T | 0.83 | -0.033 | 0.005 | -0.029 | 0.008 |
| rs2916148 | 17 | 65482109  | A | 0.45 | 0.028  | 0.004 | 0.033  | 0.006 |
| SNP          | Chromosome | rsID     | Allele | MAF    | Minor Allele Freq. | Minor Allele MAF | Minor Allele MAF |
|--------------|------------|----------|--------|--------|--------------------|------------------|------------------|
| rs3760381    | 17         | 43047083 | A      | 0.25   | 0.027              | 0.004            | 0.030            |
| rs412000     | 17         | 56709058 | C      | 0.56   | 0.022              | 0.004            | 0.025            |
| rs4365329    | 17         | 31625887 | A      | 0.54   | 0.019              | 0.003            | 0.025            |
| rs55846845   | 17         | 50092201 | A      | 0.52   | 0.021              | 0.003            | 0.021            |
| rs58681483   | 17         | 57934654 | A      | 0.92   | 0.035              | 0.006            | 0.055            |
| rs72829706   | 17         | 54173733 | A      | 0.96   | 0.056              | 0.009            | 0.052            |
| rs72841368   | 17         | 61391114 | A      | 0.81   | -0.030             | 0.004            | -0.030           |
| rs8072058    | 17         | 55734198 | A      | 0.78   | -0.028             | 0.005            | -0.031           |
| rs1013987    | 18         | 22630836 | T      | 0.40   | -0.029             | 0.004            | -0.022           |
| rs1025601    | 18         | 73056278 | T      | 0.39   | -0.022             | 0.004            | -0.016           |
| rs11152350   | 18         | 60240352 | A      | 0.47   | -0.028             | 0.004            | -0.029           |
| rs12969848   | 18         | 38152835 | T      | 0.53   | 0.036              | 0.004            | 0.036            |
| rs1788784    | 18         | 21159630 | A      | 0.34   | -0.027             | 0.004            | -0.043           |
| rs2580160    | 18         | 1816036  | A      | 0.56   | 0.028              | 0.004            | 0.024            |
| rs34329963   | 18         | 64526233 | T      | 0.11   | -0.032             | 0.005            | -0.039           |
| rs4419127    | 18         | 31663654 | A      | 0.66   | 0.044              | 0.004            | 0.060            |
| rs4800998    | 18         | 53429655 | A      | 0.18   | 0.039              | 0.005            | 0.057            |
| rs62082402   | 18         | 5186566  | T      | 0.19   | 0.050              | 0.005            | 0.060            |
| rs9950528    | 18         | 35762461 | A      | 0.65   | -0.024             | 0.004            | -0.025           |
| rs9956387    | 18         | 44773382 | A      | 0.50   | -0.020             | 0.003            | -0.018           |
| rs9964420    | 18         | 56824041 | A      | 0.30   | -0.049             | 0.004            | -0.064           |
| rs10402849   | 19         | 2695661  | T      | 0.20   | 0.026              | 0.004            | 0.020            |
| rs11670534   | 19         | 47003906 | T      | 0.16   | -0.031             | 0.005            | -0.026           |
| rs36055559   | 19         | 5799433  | A      | 0.17   | -0.036             | 0.005            | -0.045           |
| rs56113850   | 19         | 41353107 | T      | 0.42   | -0.023             | 0.004            | -0.031           |
| rs58876439   | 19         | 42600984 | A      | 0.07   | 0.047              | 0.007            | 0.053            |
| rs7248205    | 19         | 10770305 | T      | 0.60   | 0.027              | 0.004            | 0.032            |
| rs73026775   | 19         | 31052954 | A      | 0.12   | -0.034             | 0.006            | -0.041           |
| rs9636202    | 19         | 18449238 | A      | 0.27   | -0.026             | 0.004            | -0.023           |
| rs1474754    | 20         | 20077178 | A      | 0.26   | -0.021             | 0.004            | -0.029           |
| rs1737893    | 20         | 31051699 | T      | 0.38   | -0.025             | 0.004            | -0.028           |
| rs2072727    | 20         | 43538733 | T      | 0.43   | 0.028              | 0.003            | 0.033            |
| rs57236847   | 20         | 44668401 | C      | 0.60   | 0.027              | 0.004            | 0.030            |
| rs6047481    | 20         | 21539564 | A      | 0.67   | 0.025              | 0.004            | 0.025            |
| rs6131805    | 20         | 16222093 | T      | 0.40   | 0.026              | 0.004            | 0.026            |
| rs6131942    | 20         | 17348608 | A      | 0.42   | -0.026             | 0.003            | -0.033           |
| rs139911     | 22         | 40704052 | T      | 0.57   | -0.034             | 0.004            | -0.024           |
| rs28459838   | 22         | 35846168 | T      | 0.24   | 0.027              | 0.004            | 0.032            |
| rs6007594    | 22         | 45728370 | A      | 0.26   | -0.025             | 0.004            | -0.025           |
| rs695459     | 22         | 28848278 | T      | 0.39   | -0.022             | 0.004            | -0.019           |
Chr, chromosome; EA, effect allele; EAF, effect allele frequency; SE, standard error.
Supplementary Table 4. Results of multiple testing correction for combined associations by the false discovery rate (FDR) method

| Cancer       | Original P value | Critical Value | Benjamini-Hochberg Adjusted P value | Significant using an FDR of 0.05? |
|--------------|------------------|----------------|-------------------------------------|----------------------------------|
| Digestive tract | 0.007            | 0.007          | 0.050                               | Yes                              |
| Colorectum   | 0.009            | 0.014          | 0.031                               | Yes                              |
| Stomach      | 0.014            | 0.021          | 0.032                               | Yes                              |
| Biliary      | 0.108            | 0.029          | 0.189                               | No                               |
| Liver        | 0.525            | 0.036          | 0.735                               | No                               |
| Pancreas     | 0.849            | 0.043          | 0.991                               | No                               |
| Oesophagus   | 0.857            | 0.050          | 0.857                               | No                               |
Supplementary Table 5. Associations between genetic liability to chronotype and cancers of digestive tract, stomach, and colorectum in the analysis where the exposure data were obtained from 23andMe

| Cancer            | Cochran’s Q | $P_{\text{intercept}}$ | Inverse variance weighted | Weighted median | MR-Egger | Contamination mixture |
|-------------------|-------------|-------------------------|----------------------------|-----------------|----------|-----------------------|
|                   |             |                         | OR  95% CI  | P   | OR  95% CI  | P   | OR  95% CI  | P   | OR  95% CI  | P   |
| **UK Biobank**    |             |                         |              |     |              |     |              |     |              |     |
| Digestive tract   | 318         | 0.561                   | 0.96 0.91-1.01 | 0.085 | 0.94 0.87-1.02 | 0.161 | 0.99 0.88-1.11 | 0.844 | 0.96 0.91-1.01 | 0.145 |
| Stomach           | 332         | 0.943                   | 0.85 0.73-1.00 | 0.053 | 0.84 0.66-1.08 | 0.185 | 0.84 0.58-1.23 | 0.379 | 0.70 0.57-0.92 | 0.016 |
| Colorectum        | 390         | 0.492                   | 0.94 0.87-1.00 | 0.048 | 0.93 0.84-1.03 | 0.177 | 0.98 0.84-1.15 | 0.833 | 0.88 0.82-0.95 | 0.003 |
| **FinnGen**       |             |                         |              |     |              |     |              |     |              |     |
| Digestive tract   | 301         | 0.886                   | 0.94 0.88-1.00 | 0.059 | 0.93 0.84-1.03 | 0.141 | 0.95 0.81-1.11 | 0.499 | 0.93 0.87-1.01 | 0.097 |
| Stomach           | 292         | 0.301                   | 0.89 0.75-1.06 | 0.204 | 1.00 0.75-1.33 | 0.992 | 1.09 0.72-1.65 | 0.692 | 1.07 0.81-1.40 | 0.559 |
| Colorectum        | 307         | 0.429                   | 0.94 0.86-1.02 | 0.133 | 0.94 0.82-1.08 | 0.402 | 1.01 0.83-1.23 | 0.944 | 0.87 0.79-0.96 | 0.009 |
| **Meta-analysis** |             |                         |              |     |              |     |              |     |              |     |
| Digestive tract   |             |                         | 0.95 0.91-0.99 | 0.012 |              |     |              |     |              |     |
| Stomach           |             |                         | 0.87 0.77-0.98 | 0.022 |              |     |              |     |              |     |
| Colorectum        |             |                         | 0.94 0.89-0.99 | 0.013 |              |     |              |     |              |     |

CI indicates confidence interval; OR, odds ratio.

$P_{\text{intercept}}$ is the $P$ for MR-Egger intercept test and a $P_{\text{intercept}}$ <0.05 indicates the horizontal pleiotropy.