**Supplementary Table S1.** Modeling the association between distance from time zone meridian and HCC incidence (SEER 2000-2014)

|  |  |  |  |
| --- | --- | --- | --- |
| **Modela** | **Cases (*N*)** | **IRR (95% CI)b** | ***P*** |
| Age at diagnosis, sex, race/ethnicity, year of diagnosis, SEER registryc | 56,347 | 1.10 (1.02-1.18) | 0.01 |
| Alcohol consumption, smoking, obesity, diabetes | 56,347 | 1.10 (1.03-1.18) | 0.01 |
| Shift work occupation | 56,347 | 1.10 (1.02-1.18) | 0.01 |
| Median household income, Bachelor’s degree, unemployed, poverty | 56,347 | 1.10 (1.04-1.16) | <0.01 |
| Foreign born, urbanicity | 56,347 | 1.11 (1.05-1.18) | <0.01 |
| Outdoor light at night | 56,347 | 1.11 (1.05-1.18) | <0.01 |
| UVd | 56,347 | 1.07 (1.01-1.14) | 0.03 |

Abbreviations: CI, confidence interval; HCC, hepatocellular carcinoma; IRR, incidence rate ratio; SEER, Surveillance, Epidemiology, and End Results; UV, ultraviolet radiation.

aEach Poisson regression model additionally adjusts for the variables in the previous models (i.e., rows).

bIRR for distance from time zone meridian per 5 degree increase in longitude moving east to west within a time zone.

cThis is the basic model presented in the main analysis in Table 2.

dThis is the fully adjusted model presented in the main analysis in Table 2.

**Supplementary Table S2.** Associations between distance from time zone meridian (moving west to east) and HCC incidence (SEER 2000-2014)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Distance from time zone meridian (per 5 degree increase)a** | **Cases (*N*)** | **Basicb**  **IRR (95% CI)** | ***P*** | **Fully adjustedc**  **IRR (95% CI)** | ***P*** |
| Main analyses | 56,347 | 0.91 (0.85-0.98) | 0.01 | 0.93 (0.87-0.99) | 0.03 |

Abbreviations: CI, confidence interval; HCC, hepatocellular carcinoma; IRR, incidence rate ratio; SEER, Surveillance, Epidemiology, and End Results.

aPer 5 degrees in longitude moving west to east within a time zone.

bAdjusted for age at diagnosis, sex, race/ethnicity, year of diagnosis, and SEER registry.

cAdditionally adjusted for the following county-level variables: alcohol consumption; smoking; obesity; diabetes; shift work occupation; median household income; Bachelor’s degree or higher; unemployed; poverty; foreign born; urbanicity; outdoor light at night; UV.

**Supplementary Table S3.** Association between distance from time zone meridian and HCC incidence stratified by sex, shift work occupation, alcohol consumption, urbanicity, obesity, diabetes, UV, and residential mobility

|  |  |  |  |
| --- | --- | --- | --- |
| **Distance from time zone meridian (per 5 degree increase)a** | **Cases (*N*)** | **Fully adjustedb**  **IRR (95% CI)** | ***P for interaction*** |
| Sex |  |  | 0.33 |
| Male | 43,435 | 1.08 (1.00-1.17) |  |
| Female | 12,912 | 0.98 (0.91-1.06) |  |
| Shift work occupationc,d |  |  | 0.15 |
| Low | 51,808 | 1.12 (1.02-1.22) |  |
| High | 4,539 | 1.01 (0.96-1.07) |  |
| Alcohol consumptionc,e |  |  | 0.28 |
| Low | 12,264 | 1.12 (1.06-1.19) |  |
| High | 44,083 | 1.08 (0.98-1.19) |  |
| Urbanicity |  |  | 0.31 |
| Rural | 460 | 0.93 (0.80-1.07) |  |
| Urban | 55,887 | 1.08 (1.01-1.15) |  |
| Obesityc,f |  |  | 0.01 |
| Low | 47,078 | 1.08 (1.00-1.18) |  |
| High | 9,269 | 1.03 (0.96-1.11) |  |
| Diabetesc,g |  |  | 0.37 |
| Low | 33,627 | 1.05 (0.97-1.13) |  |
| High | 22,720 | 1.05 (0.96-1.16) |  |
| UVc,h |  |  | 0.07 |
| Low | 20,857 | 1.09 (1.00-1.20) |  |
| High | 35,490 | 1.14 (1.01-1.29) |  |
| Residential mobilityi |  |  | 0.10 |
| Non-mover | 31,107 | 1.07 (1.00-1.14) |  |
| Mover | 25,240 | 1.08 (0.96-1.22) |  |

Abbreviations: CI, confidence interval; HCC, hepatocellular carcinoma; IRR, incidence rate ratio; SEER, Surveillance, Epidemiology, and End Results; UV, ultraviolet radiation.

aPer 5 degrees in longitude moving east to west within a time zone.

bAdjusted for age at diagnosis, sex, race/ethnicity, year of diagnosis, and SEER registry, and the following county-level variables: alcohol consumption; smoking; obesity; diabetes; shift work occupation; median household income; Bachelor’s degree or higher; unemployed; poverty; foreign born; urbanicity; outdoor light at night; UV.

cWe stratified by the median value of UV and of the sex-specific prevalence of shift work occupation, alcohol consumption, obesity, and diabetes across all 607 counties included in the analysis.

dLow shift work occupation prevalence refers to cases residing in a county where <31.2% of the female population or <38.1% of the male population was employed in shift work occupation. High shift work occupation prevalence refers to cases residing in a county where ≥31.2% of the female population or ≥38.1% of the male population was employed in shift work occupation.

eLow alcohol consumption prevalence refers to cases residing in a county where <3.3% of the female population or <7.9% of the male population consumed alcohol (an average of >1 drink per day for females or >2 drinks per day for males in the past 30 days). High alcohol consumption prevalence refers to cases residing in a county where ≥3.3% of the female population or ≥7.9% of the male population consumed alcohol.

fLow obesity prevalence refers to cases residing in a county where <31.2% of the female population or <28.9% of the male population were obese. High obesity prevalence refers to cases residing in a county where ≥31.2% of the female population or ≥28.9% of the male population were obese.

gLow diabetes prevalence refers to cases residing in a county where <9.9% of the female population or <12.4% of the male population had diabetes. High diabetes prevalence refers to cases residing in a county where ≥9.9% of the female population or ≥12.4% of the male population had diabetes.

hLow UV refers to cases residing in a county where UV exposure was <195.8 mW/m2. High UV refers to cases residing in a county where UV exposure was ≥195.8 mW/m2.

iNon-movers were defined as individuals who resided in a county where ≥51.9% (20th percentile of all 607 counties) of the population stayed in the same home. Movers resided in a county where <51.9% of the population stayed in the same home.

 **Supplementary Figure S1**. Flowchart for study analytic sample of n=56,347 HCC cases diagnosed between 2000 and 2014 from SEER. Records for confirmed incident primary HCC cases were ascertained from SEER who were not missing county FIPS codes (required to estimate exposure) and were not missing information regarding age, sex, race/ethnicity, year of diagnosis, and SEER registry.