**SUPPLEMENTARY MATERIALS**

**Table S1. Tobacco user group definitions**

|  |  |
| --- | --- |
| **Tobacco user group** | **Definition** |
| Daily user | Is an established (i.e. not experimental) everyday user of at least one tobacco product or an established everyday polyuser (user of multiple products) and does not use NRT |
| Daily user, exclusive cigarettes | Has ever smoked 100 cigarettes and now smokes cigarettes every day, and does not use any other tobacco product |
| Daily user, exclusive smokeless | Is an established user of smokeless tobacco or snus pouches or dissolvable tobacco, and uses every day, and does not use any other tobacco product |
| Daily user, exclusive e-cigarettes | Is an established user of e-cigarettes, and uses every day, and does not use any other tobacco product |
| Daily user, exclusive cigar | Is an established user of traditional cigars or filtered cigars or cigarillos, and uses every day, and does not use any other tobacco product |
| Daily user, exclusive pipe | Is an established user of tobacco pipes, and uses every day, and does not use any other tobacco product |
| Daily user, exclusive hookah | Is an established user of hookah, and uses every day, and does not use any other tobacco product |
| Daily user, polyuser | Is an established everyday user of at least one tobacco product, but not an exclusive user of any one tobacco product |
| Nonuser | Former and never users |
| Former user | Has been an established or experimental user of a tobacco product, and does not now use any tobacco product or NRT, last use within the past 12 months |
| Never user | Has never used any tobacco product or NRT |

NRT = nicotine replacement therapy

 **Table S2. Sample-weighted cotinine concentration with 95% CI (ng/mL) in daily tobacco users at selected percentiles**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **N** | **5th** | **10th** | **25th** | **50th** | **75th** | **90th** | **95th** |
| **All Adults** | 3,741 | 40.7 (34.0, 48.7) | 79.4 (68.4, 92.2) | 157.8 (147.6, 168.7) | 244.4 (235.7, 253.5) | 352.1 (343.3, 361.1) | 435.3 (420.4, 450.7) | 520.0 (499.7, 541.1) |
| **Sex** |   |   |   |   |   |   |   |   |
| Female | 1,678 | 39.9 (30.6, 52.1) | 75.1 (62.2, 90.8) | 142.2 (131.7, 153.5) | 232.6 (216.9, 249.5) | 330.4 (308.6, 353.7) | 392.0 (380.8, 403.5) | 448.8 (396.7, 507.9) |
| Male | 2,063 | 41.4 (31.9, 53.7) | 84.5 (68.2, 104.6) | 168.3 (157.6, 179.7) | 256.1 (242.6, 270.4) | 363.5 (352.2, 375.2) | 468.1 (453.5, 483.1) | 560.4 (529.7, 592.9) |
| **Age Group** |   |   |   |   |   |   |   |   |
| 18-24 y | 807 | 15.3 (8.5, 27.4) | 36.0 (23.1, 56.0) | 94.8 (79.6, 112.8) | 172.1 (158.9, 186.4) | 263.6 (239.8, 289.9) | 358.8 (344.2, 374.1) | 417.7 (363.1, 480.6) |
| 25-34 y | 822 | 37.7 (28.9, 49.1) | 63.6 (55.4, 73.0) | 139.8 (126.7, 154.3) | 226.7 (212.2, 242.1) | 333.8 (316.8, 351.6) | 397.6 (379.4, 416.8) | 489.5 (432.2, 554.3) |
| 35-44 y | 672 | 53.8 (40.1, 72.1) | 103.7 (89.7, 119.9) | 166.7 (150.4, 184.8) | 258.2 (239.9, 277.9) | 348.8 (338.9, 359.0) | 440.3 (403.9, 480.1) | 537.8 (494.0, 585.4) |
| 45-54 y | 738 | 77.2 (53.1, 112.1) | 114.4 (95.4, 137.3) | 198.2 (185.6, 211.7) | 279.1 (262.5, 296.8) | 384.1 (359.4, 410.5) | 507.2 (465.9, 552.2) | 609.4 (566.9, 655.1) |
| 55+ y | 702 | 45.9 (28.4, 74.2) | 98.2 (83.7, 115.2) | 174.3 (151.7, 200.3) | 262.1 (237.6, 289.1) | 369.1 (349.8, 389.5) | 445.6 (413.9, 479.8) | 523.8 (470.1, 583.6) |
| **Race/Ethnicity** |   |   |   |   |   |   |   |   |
| Hispanic | 348 | 3.6 (0.1, 137.2) | 31.4 (17.1, 57.4) | 71.0 (52.9, 95.3) | 163.5 (136.7, 195.6) | 249.8 (224.5, 278.0) | 331.9 (292.8, 376.3) | 392.8 (371.0, 415.9) |
| Non-Hispanic Black | 474 | 20.4 (6.9, 60.2) | 59.8 (32.0, 111.8) | 166.3 (123.0, 224.7) | 286.9 (234.6, 350.8) | 374.5 (341.3, 411.1) | 455.8 (421.1, 493.4) | 524.8 (424.4, 649.1) |
| Non-Hispanic White | 2,646 | 56.8 (48.5, 66.4) | 97.8 (91.2, 104.8) | 168.4 (161.1, 176.0) | 250.1 (242.4, 258.1) | 354.4 (341.9, 367.3) | 436.1 (423.3, 449.3) | 523.3 (499.6, 548.0) |
| Other/Multi Race | 273 | 10.8 (<LOD, 17,397.0) | 28.1 (11.9, 66.2) | 120.5 (94.5, 153.7) | 204.9 (183.7, 228.6) | 314.3 (277.8, 355.7) | 488.4 (383.5, 621.9) | 552.7 (489.8, 623.6) |
| **Education** |   |   |   |   |   |   |   |   |
| Less than High School | 1,126 | 42.8 (30.6, 59.7) | 97.0 (77.4, 121.6) | 175.2 (165.2, 185.8) | 254.3 (242.6, 266.5) | 357.7 (346.6, 369.2) | 455.3 (424.6, 488.2) | 520.9 (493.4, 549.9) |
| High School Graduate | 934 | 37.6 (27.4, 51.5) | 80.1 (59.8, 107.4) | 163.0 (146.2, 181.7) | 247.5 (230.3, 265.9) | 352.7 (333.8, 372.6) | 434.4 (395.2, 477.4) | 537.1 (465.7, 619.5) |
| Some College | 1,380 | 41.0 (25.8, 65.2) | 82.6 (64.0, 106.7) | 147.1 (130.6, 165.6) | 239.6 (217.6, 263.8) | 348.8 (327.8, 371.1) | 425.7 (404.9, 447.6) | 509.1 (492.3, 526.5) |
| Bachelor’s Degree + | 301 | 30.3 (17.7, 51.7) | 52.5 (41.0, 67.3) | 131.2 (110.1, 156.3) | 214.5 (195.7, 235.0) | 317.3 (298.3, 337.6) | 423.8 (387.5, 463.4) | 496.4 (418.4, 588.9) |

CI = confidence interval, LOD = limit of detection (0.015 ng/mL)

**Table S3. Sample-weighted *trans*-3′-hydroxycotinine concentration with 95% CI (ng/mL) in daily tobacco users at selected percentiles**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **N** | **5th** | **10th** | **25th** | **50th** | **75th** | **90th** | **95th** |
| **All Adults** | 3,741 | 12.4 (9.6, 16.0) | 22.9 (20.6, 25.4) | 50.4 (46.8, 54.3) | 89.6 (85.3, 94.1) | 147.5 (137.8, 158.0) | 206.6 (198.9, 214.6) | 261.8 (243.5, 281.5) |
| **Sex** |   |   |   |   |   |   |   |   |
| Female | 1,678 | 14.8 (12.1, 18.1) | 25.0 (21.4, 29.2) | 53.8 (48.1, 60.1) | 93.0(85.4, 101.4) | 152.6 (137.3, 169.5) | 209.9 (195.8, 225.1) | 263.9 (236.2, 294.8) |
| Male | 2,063 | 10.9 (6.6, 18.2) | 22.0 (18.5, 26.2) | 48.1 (44.7, 51.7) | 88.0 (84.3, 91.9) | 143.9 (133.9, 154.6) | 203.9 (196.6, 211.3) | 259.9 (236.7, 285.4) |
| **Age Group** |   |   |   |   |   |   |   |   |
| 18-24 y | 807 | 3.6 (1.5, 8.5) | 9.5 (5.4, 16.6) | 25.3 (20.8, 30.8) | 49.4 (43.0, 56.7) | 83.4 (76.8, 90.5) | 121.8 (107.9, 137.4) | 170.1 (151.5, 191.0) |
| 25-34 y | 822 | 11.9 (8.5, 16.6) | 18.1 (15.3, 21.4) | 38.8 (31.8, 47.3) | 75.8 (67.8, 84.8) | 124.7 (112.4, 138.3) | 179.2 (155.8, 206.2) | 205.3 (192.3, 219.1) |
| 35-44 y | 672 | 16.2 (10.7, 24.4) | 27.2 (20.8, 35.4) | 56.5 (50.0, 63.9) | 93.8 (82.1, 107.3) | 157.5 (135.5, 183.1) | 206.1 (184.8, 229.8) | 241.5 (223.8, 260.7) |
| 45-54 y | 738 | 23.2 (18.0, 29.9) | 39.3 (32.3, 47.8) | 67.9 (59.9, 77.0) | 112.0 (104.8, 119.7) | 168.3 (154.7, 183.0) | 228.8 (203.7, 257.0) | 287.9 (258.3, 320.8) |
| 55+ y | 702 | 13.6 (4.7, 39.5) | 39.5 (28.6, 54.6) | 73.1 (63.2, 84.5) | 118.5 (99.0, 141.9) | 191.2 (172.7, 211.6) | 263.3 (229.4, 302.2) | 330.2 (301.3, 361.9) |
| **Race/Ethnicity** |   |   |   |   |   |   |   |   |
| Hispanic | 348 | 1.1 (0.1, 17.5) | 9.6 (4.6, 19.9) | 24.7 (20.1, 30.3) | 50.9 (43.0, 60.3) | 103.1 (91.4, 116.3) | 151.4 (133.3, 172.0) | 180.0 (154.1, 210.3) |
| Non-Hispanic Black | 474 | 4.0 (1.2, 13.1) | 13.9 (8.3, 23.3) | 40.7 (30.2, 54.8) | 75.9 (62.5, 92.2) | 146.4 (101.2, 211.9) | 197.4 (170.4, 228.6) | 225.7 (194.5, 261.9) |
| Non-Hispanic White | 2,646 | 18.4 (15.4, 22.0) | 30.9 (27.8, 34.3) | 58.9 (54.9, 63.2) | 98.0 (92.5, 103.7) | 156.2 (146.2, 167.0) | 215.7 (206.5, 225.3) | 270.7 (253.9, 288.7) |
| Other/Multi Race | 273 | 0.2 (<LOD, 7.1) | 3.8 (0.1, 118.5) | 25.8 (16.7, 39.8) | 61.6 (51.1, 74.3) | 115.9 (104.3, 128.9) | 184.9 (145.7, 234.6) | 253.1 (157.9, 405.5) |
| **Education** |   |   |   |   |   |   |   |   |
| Less than High School | 1,126 | 12.9 (8.8, 19.0) | 25.8 (20.5, 32.5) | 57.7 (50.9, 65.4) | 92.0 (85.0, 99.7) | 144.1 (130.9, 158.7) | 216.8 (199.4, 235.7) | 281.8 (234.5, 338.8) |
| High School Graduate | 934 | 12.5 (8.4, 18.5) | 22.0 (17.9, 26.9) | 48.4 (41.3, 56.7) | 88.0 (81.7, 94.8) | 146.8 (128.9, 167.1) | 199.8 (187.4, 213.1) | 250.6 (228.7, 274.7) |
| Some College | 1,380 | 13.4 (7.7, 23.4) | 24.6 (20.4, 29.6) | 48.8 (42.4, 56.1) | 89.5 (79.6, 100.6) | 149.4 (129.1, 173.0) | 203.4 (189.1, 218.7) | 257.0 (229.7, 287.5) |
| Bachelor’s Degree + | 301 | 5.0 (0.2, 103.6) | 16.7 (10.7, 26.1) | 48.1 (35.4, 65.4) | 86.2 (74.2, 100.2) | 151.6 (137.4, 167.2) | 215.5 (199.9, 232.4) | 234.6 (214.5, 256.5) |

CI = confidence interval, LOD = limit of detection (0.015 ng/mL)

**Table S4**. **Sample-weighted nicotine biomarker geometric mean concentration (95% CI) in nonusers by demographic groups**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **N** | **Cotinine, ng/mL** | ***trans*-3′-Hydroxycotinine, ng/mL** | **Cotinine +*****trans*-3′-Hydroxycotinine,\* pmol/mL** |
| **All Adults** | 1,271 | 0.033 (0.028, 0.037)† | 0.021 (0.018, 0.023)† | 0.303 (0.268, 0.343)† |
| **Sex** |   |   |   |   |
| Female | 804 | 0.028 (0.024, 0.032)† | 0.019 (0.017, 0.021)† | 0.265 (0.232, 0.302)† |
| Male | 467 | 0.042 (0.032, 0.055) | 0.023 (0.019, 0.029)† | 0.377 (0.294, 0.485)† |
| **Age Group** |   |   |   |   |
| 18-24 y | 489 | 0.053 (0.036, 0.077) | 0.029 (0.021, 0.040)† | 0.467 (0.325, 0.673)† |
| 25-34 y | 224 | 0.036 (0.027, 0.048) | 0.019 (0.016, 0.022)† | 0.326 (0.254, 0.417)† |
| 35-44 y | 151 | 0.024 (0.020, 0.028)† | 0.015 (<LOD, 0.017)† | 0.222 (0.191, 0.258)† |
| 45-54 y | 152 | 0.040 (0.024, 0.068)† | 0.028 (0.017, 0.045)† | 0.382 (0.229, 0.637)† |
| 55+ y | 255 | 0.025 (0.021, 0.029)† | 0.018 (0.015, 0.020)† | 0.237 (0.204, 0.276)† |
| **Race/Ethnicity** |   |   |   |   |
| Hispanic | 291 | 0.029 (0.021, 0.038)† | 0.019 (0.015, 0.023)† | 0.268 (0.208, 0.345)† |
| Non-Hispanic Black | 175 | 0.082 (0.046, 0.144) | 0.037 (0.022, 0.061) | 0.688 (0.398, 1.188) |
| Non-Hispanic White | 695 | 0.027 (0.023, 0.033)† | 0.019 (0.017, 0.023)† | 0.263 (0.223, 0.311)† |
| Other/Multi Race | 110 | 0.047 (0.027, 0.082) | 0.018 (<LOD, 0.024)† | 0.387 (0.240, 0.624)† |
| **Education** |   |   |   |   |
| Less than High School | 225 | 0.053 (0.038, 0.075) | 0.030 (0.022, 0.041)† | 0.475 (0.341, 0.661)† |
| High School Graduate | 301 | 0.047 (0.031, 0.071) | 0.026 (0.018, 0.038)† | 0.424 (0.285, 0.631)† |
| Some College | 466 | 0.035 (0.028, 0.043) | 0.021 (0.018, 0.025)† | 0.318 (0.262, 0.384)† |
| Bachelor's Degree + | 279 | 0.017 (0.015, 0.020)† | <LOD† | 0.171 (0.153, 0.192)† |

CI = confidence interval, LOD = limit of detection (0.015 ng/mL)

\*Molar sum of cotinine and *trans*-3′-hydroxycotinine

†Estimate does not meet the statistical reliability criterion of proportion of biomarker results ≤ 40% below the LOD

**Table S5. Sample-weighted cotinine concentration with 95% CI (ng/mL) in nonusers by demographic groups at selected percentiles**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   | **N** | **50th** | **75th** | **90th** | **95th** |
| **All Adults** | 1,271 | 0.016 (<LOD, 0.020) | 0.048 (0.039, 0.060) | 0.264 (0.164, 0.425) | 0.744 (0.312, 1.772) |
| **Sex** |   |   |   |   |   |
| Female | 804 | <LOD | 0.041 (0.032, 0.052) | 0.178 (0.082, 0.387) | 0.541 (0.227, 1.288) |
| Male | 467 | 0.021 (<LOD, 0.031) | 0.063 (0.039, 0.102) | 0.381 (0.207, 0.701) | 1.488 (0.252, 8.788) |
| **Age Group** |   |   |   |   |   |
| 18-24 | 489 | 0.024 (0.016, 0.037) | 0.102 (0.044, 0.240) | 0.718 (0.240, 2.151) | 3.180 (0.368, 27.518) |
| 25-34 | 224 | 0.016 (<LOD, 0.031) | 0.058 (0.027, 0.122) | 0.314 (0.087, 1.131) | 0.743 (0.414, 1.332) |
| 35-44 | 151 | <LOD | 0.036 (0.023, 0.056) | 0.061 (0.047, 0.080) | 0.228 (0.122, 0.427) |
| 45-54 | 152 | <LOD | 0.068 (0.019, 0.246) | 0.500 (0.076, 3.277) | 1.505 (<LOD, 196.467) |
| 55+ | 255 | <LOD | 0.032 (0.024, 0.044) | 0.115 (0.074, 0.180) | 0.238 (0.128, 0.445) |
| **Race/Ethnicity** |   |   |   |   |   |
| Hispanic | 291 | <LOD | 0.034 (0.020, 0.058) | 0.192 (0.062, 0.599) | 0.463 (0.060, 3.575) |
| Non-Hispanic Black | 175 | 0.048 (0.019, 0.120) | 0.207 (0.101, 0.425) | 0.829 (0.104, 6.619) | 5.973 (0.016, 2229.990) |
| Non-Hispanic White | 695 | <LOD | 0.037 (0.029, 0.047) | 0.143 (0.046, 0.446) | 0.530 (0.201, 1.395) |
| Other/Multi race | 110 | 0.039 (0.019, 0.080) | 0.061 (0.033, 0.115) | 0.722 (0.057, 9.083) | 0.739 (0.366, 1.494) |
| **Education** |   |   |   |   |   |
| Less than High School | 225 | 0.027 (0.015, 0.049) | 0.100 (0.058, 0.174) | 0.398 (0.082, 1.921) | 4.071 (0.216, 76.745) |
| High School Graduate | 301 | 0.024 (0.015, 0.037) | 0.097 (0.040, 0.236) | 0.526 (0.233, 1.186) | 1.535 (0.381, 6.177) |
| Some College | 466 | 0.021 (<LOD, 0.032) | 0.054 (0.038, 0.077) | 0.270 (0.191, 0.380) | 0.690 (0.298, 1.599) |
| Bachelor's Degree + | 279 | <LOD | 0.017 (<LOD, 0.020) | 0.047 (0.033, 0.066) | 0.100 (0.044, 0.231) |

CI = confidence interval, LOD = limit of detection (0.015 ng/mL)

**Table S6. Sample-weighted *trans*-3′-hydroxycotinine concentration with 95% CI (ng/mL) in nonusers by demographic groups at selected percentiles**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   | **N** | **50th** | **75th** | **90th** | **95th** |
| **All Adults** | 1,271 | <LOD | 0.018 (<LOD, 0.023) | 0.092 (0.058, 0.147) | 0.304 (0.136, 0.679) |
| **Sex** |   |   |   |   |   |
| Female | 804 | <LOD | 0.017 (<LOD, 0.025) | 0.081 (0.054, 0.123) | 0.242 (0.114, 0.516) |
| Male | 467 | <LOD | 0.020 (<LOD, 0.027) | 0.144 (0.049, 0.424) | 0.661 (0.179, 2.442) |
| **Age Group** |   |   |   |   |   |
| 18-24 | 489 | <LOD | 0.034 (<LOD, 0.082) | 0.302 (0.171, 0.531) | 1.324 (0.195, 8.986) |
| 25-34 | 224 | <LOD | 0.017 (<LOD, 0.024) | 0.051 (0.030, 0.089) | 0.167 (0.045, 0.620) |
| 35-44 | 151 | <LOD | <LOD | 0.030 (0.019, 0.047) | 0.055 (0.034, 0.091) |
| 45-54 | 152 | <LOD | 0.020 (<LOD, 0.077) | 0.239 (0.028, 2.014) | 0.956 (<LOD, 79.209) |
| 55+ | 255 | <LOD | 0.016 (<LOD, 0.025) | 0.064 (0.046, 0.088) | 0.105 (0.050, 0.220) |
| **Race/Ethnicity** |   |   |   |   |   |
| Hispanic | 291 | <LOD | <LOD | 0.057 (0.037, 0.088) | 0.123 (0.015, 0.987) |
| Non-Hispanic Black | 175 | <LOD | 0.061 (0.040, 0.092) | 0.270 (0.058, 1.254) | 1.707 (<LOD, 495.822) |
| Non-Hispanic White | 695 | <LOD | 0.016 (<LOD, 0.021) | 0.091 (0.037, 0.224) | 0.301 (0.148, 0.614) |
| Other/Multi race | 110 | <LOD | 0.015 (<LOD, 0.021) | 0.038 (<LOD, 0.226) | 0.132 (0.033, 0.527) |
| **Education** |   |   |   |   |   |
| Less than High School | 225 | <LOD | 0.042 (0.021, 0.087) | 0.302 (0.089, 1.029) | 1.526 (0.108, 21.665) |
| High School Graduate | 301 | <LOD | 0.030 (<LOD, 0.070) | 0.226 (0.060, 0.852) | 0.988 (0.114, 8.586) |
| Some College | 466 | <LOD | 0.022 (0.017, 0.029) | 0.090 (0.054, 0.151) | 0.247 (0.132, 0.462) |
| Bachelor's Degree + | 279 | <LOD | <LOD | <LOD | 0.036 (0.017, 0.076) |

CI = confidence interval, LOD = limit of detection (0.015 ng/mL)



