# Supplementary Materials

# Supplemental Figure 1. Flowchart of men included in the analysis of residential proximity to major roadways in relation to sperm characteristics our study.



# Supplementary Table 1: Differences in demographics and semen sample characteristics across categories of residential distance to major roadways among 797 men (1,238 semen samples) (2000-2015).

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Categories of Distance to Major Roadways** |  |  |
| Range, m | <50 m | 50-99 m | 100-199 m | 200-399 m | ≥400 m | Total |   |
| Number of men (%) | 244 (30) | 126 (16) | 185 (23) | 125 (16) | 117 (15) | 797 (100) | p-value1 |
| **Baseline Characteristics** |  |  |  |  |  |  |  |
| Age, years | 35.9 (5.62) | 36.6 (5.73) | 36.0 (4.79) | 36.9 (5.11) | 36.9 (4.92) | 36.3 (5.28) | 0.07 |
| BMI, kg/m2 | 27.7 (5.33) | 27.4 (3.99) | 27.9 (4.49) | 27.1 (4.29) | 28.0 (4.96) | 27.7 (4.73) | 0.55 |
| BMI categories, N (%) |  |  |  |  |  |  | 0.90 |
| <25 k/m2 | 71 (29.1) | 34 (27.0) | 48 (26.0) | 39 (31.2) | 33 (28.2) | 225 (28.2) |  |
| 25-29.9 k/m2 | 117 (48.0) | 61 (48.4) | 86 (46.5) | 62 (49.6) | 54 (46.2) | 380 (47.7) |  |
| ≥30 k/m2 | 56 (23.0) | 31 (24.6) | 51 (27.6) | 24 (19.2) | 30 (25.6) | 192 (24.1) |  |
| Race, N (%) |  |  |  |  |  |  | 0.02 |
| Caucasian | 199 (81.6) | 101 (80.2) | 168 (90.8) | 110 (88.0) | 107 (91.5) | 685 (86.0) |  |
| African American | 11 (4.51) | 6 (4.76) | 4 (2.16) | 2 (1.60) | 4 (3.42) | 27 (3.39) |  |
| Asian | 14 (5.74) | 8 (6.35) | 9 (4.86) | 10 (8.00) | 2 (1.71) | 43 (5.40) |  |
| Other | 20 (8.20) | 11 (8.73) | 4 (2.16) | 3 (2.40) | 4 (3.42) | 42 (5.27) |  |
| Census Tract Median Income2, $ | 107,537 (48,759) | 96,995 (40,385) | 106,158 (43,054) | 102,150 (39,126) | 118,114 (33,859) | 106,258 (43,050) | 0.0002 |
| Education categories, N (%) |  |  |  |  |  |  | 0.04 |
| Less than college | 28 (11.5) | 24 (19.1) | 17 (9.19) | 10 (8.00) | 16 (13.7) | 95 (11.9) |  |
| College degree | 125 (51.2) | 58 (46.0) | 88 (47.6) | 69 (55.2) | 69 (59.0) | 409 (51.3) |  |
| Graduate degree | 91 (37.3) | 44 (34.9) | 80 (43.2) | 46 (36.8) | 32 (27.4) | 293 (36.8) |  |
| Reproductive diseases, N (%)3 | 75 (30.7) | 38 (30.2) | 62 (33.5) | 40 (32.0) | 40 (34.2) | 255 (32.0) | 0.93 |
| Reproductive surgeries, N (%)4 | 20 (8.20) | 12 (9.52) | 27 (14.6) | 14 (11.2) | 9 (7.69) | 82 (10.3) | 0.21 |
| Current smoking, N (%) | 18 (7.38) | 10 (7.94) | 14 (7.57) | 7 (5.60) | 11 (9.40) | 60 (7.53) | 0.86 |
| **Semen Sample Characteristics**  |  |  |  |  |  |  |  |
| Number of specimens | 354 | 202 | 310 | 200 | 172 | 1238 |  |
| Year of collection | 2007 (5) | 2008 (5) | 2008 (5) | 2007 (5) | 2006 (5) | 2007 (5) | 0.05 |
| Collected April through September, N (%) | 176 (49.7) | 105 (52.0) | 145 (46.8) | 101 (50.5) | 91 (52.9) | 618 (49.9) | 0.70 |
| Time between semen collection and analysis, mins | 23.8 (6.97) | 23.1 (4.98) | 22.5 (5.00) | 22.9 (5.54) | 23.0 (5.62) | 23.1 (5.81) | 0.14 |
| Sexual abstinence time |  |  |  |  |  |  | 0.006 |
| <2 days | 53 (15.0) | 48 (23.8) | 66 (21.3) | 29 (14.5) | 29 (16.9) | 225 (18.2) |  |
| 2-3 days | 144 (40.7) | 82 (40.6) | 114 (36.8) | 86 (43.0) | 61 (35.5) | 487 (39.3) |  |
| 3-4 days | 83 (23.5) | 41 (20.3) | 68 (21.9) | 35 (17.5) | 28 (16.3) | 255 (20.6) |  |
| >4 days | 74 (20.9) | 31 (15.4) | 62 (20.0) | 50 (25.0) | 54 (31.4) | 271 (21.9) |   |

Abbreviations: BMI; body mass index.

1 P-values are based on Chi-square test for categorical variables and Kruskal Wallis test for continuous variables.

2 Median family income in the past 12 months (in 2011 inflation-adjusted dollars) by tract from the American Community Survey 2007-2010 estimates.

3 Groin injury, testes not always in scrotum, varicocele, testicular torsion, testicular injury, hernia, epididymitis, prostatitis and seminal vesicle infection

4 Varicocelectomy, orchidopexy, hydrocelectomy, repair of hernia, urethera, or hypospadias, sympahthectomy or bladder neck surgery.

5 N (%) is presented for categorical/binary variables and mean (SD) is presented for continuous variables

# Supplementary Table 2: Differences in proximity to major roads and baseline demographics characteristics between men with sperm DNA damage, hormone, and sperm aneuploidy data and who did not among the 797 men.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Baseline Characteristics N (%) or mean (SD) 1 | Men without hormones (n=392) | Men with hormones(n=405 men) | P-value | Men without sperm DNA damage (n=408) | Men with sperm DNA damage (n=389) | P-value | Men without sperm aneuploidy (n=696) | Men with sperm aneuploidy (n=101) | P-value |
| Distance to major roads, m | 197 (325) | 242 (364) | 0.28 | 200 (338) | 241 (354 | 0.20 | 211 (329) | 282 (443) | 0.43 |
| Age, years | 36.4 (5.27) | 36.3 (5.29) | 0.98 | 36.4 (5.19) | 36.3 (5.38) | 0.98 | 36.4 (5.33) | 35.6 (4.88) | 0.21 |
| BMI, kg/m2 | 27.5 (4.45) | 27.9 (4.98) | 0.42 | 27.5 (4.55) | 27.8 (4.91) | 0.71 | 27.7 (4.80) | 27.4 (4.20) | 0.85 |
| BMI categories |  |  | 0.51 |  |  | 0.61 |  |  | 0.71 |
| <25 kg/m2 | 117 (30) | 108 (27) |  | 120 (29) | 105 (29) |  | 195 (28) | 30 (30) |  |
| 25-29.9 kg/m2 | 186 (47) | 194 (48) |  | 195 (48) | 185 (48) |  | 330 (47) | 50 (50) |  |
| ≥30 kg/m2 | 89 (23) | 103 (25) |  | 93 (23) | 99 (25) |  | 171 (25) | 21 (21) |  |
| Race |  |  | 0.07 |  |  | 0.26 |  |  | 0.12 |
| Caucasian | 341 (87) | 344 (85) |  | 355 (87) | 330 (85) |  | 597 (86) | 88 (87) |  |
| African American | 13 (3) | 14 (3) |  | 11 (3) | 16 (4) |  | 23 (3) | 4 (4) |  |
| Asian | 25 (6) | 18 (4) |  | 25 (6) | 18 (5) |  | 42 (6) | 1 (1) |  |
| Other | 13(3) | 29 (7) |  | 17 (4) | 25 (6) |  | 34 (5) | 8 (8) |  |
| Census Tract Median Income, $ | 104,607 (42,161) | 107,857 (43,886) | 0.21 | 104,819 (40,683) | 107,768 (45,405) | 0.39 | 106,694 (42,939) | 103,258 (43,904) | 0.29 |
| Education categories |  |  | 0.23 |  |  | 0.21 |  |  | 0.07 |
|  Less than college | 42 (11) | 53 (13) |  | 47 (12) | 48 (12) |  | 76 (11) | 19 (19) |  |
| College degree | 195 (50) | 214 (53) |  | 199 (49) | 210 (54) |  | 362 (52) | 47 (47) |  |
| Graduate degree | 155 (40) | 138 (34) |  | 162 (40) | 131 (34) |  | 258 (37) | 35 (35) |  |
| Current smoking | 25 (6) | 35 (9) | 0.23 | 28 (7) | 32 (8) | 0.47 | 65 (8) | 4 (4) | 0.15 |

Abbreviations: BMI; body mass index, mins; minutes.

N (%) is presented for categorical/binary variables and mean (SD) is presented for continuous variables.

P-values are based on Chi-square test for categorical variables and Kruskal Wallis test for continuous variables.

# Supplementary Table 3. Unadjusted associations between distance from residential address to nearest major roadway and semen parameters and serum reproductive hormone concentrations.

|  |  |  |
| --- | --- | --- |
|   | **Categories of Distance to Nearest Major Roadway** |  |
| **Adjusted means (95% CI)1** | <50 m | 50-99 m | 100-199 m | 200-399 m | ≥400 m | P for trend | Adjusted change per 500m increase (95% CI)2 |
| **Semen Quality Parameters (n=797 men, 1238 samples)** | 244 men / 354 semen samples | 126 men / 202 semen samples | 185 men / 310 semen samples | 125 men / 200 semen samples | 117 men / 172 semen samples |  |  |
| Ejaculate Volume (mL) | 2.65 (2.47,2.84) | 2.49 (2.26,2.74) | 2.70 (2.50,2.93) | 2.66 (2.42,2.93) | 2.54 (2.30,2.81) | 0.66 | 0.01 (-5.35,5.71) |
| Sperm Concentration (million/mL) | 59.2 (52.0,67.4) | 55.9 (46.7,66.9) | 58.4 (50.4,67.8) | 51.8 (43.2,62.0) | 73.3 (60.8,88.4) | 0.07 | 6.29 (-4.40,17.9) |
| Total Sperm Count (million) | 156 (137,179) | 139 (115,167) | 158 (135,184) | 138 (114,166) | 186 (153,226) | 0.13 | 6.24 (-4.40,18.2) |
| % Total Sperm Motility | 48.7 (46.0,51.5) | 45.3 (41.4,49.2) | 47.0 (43.8,50.1) | 48.3 (44.4,52.1) | 50.3 (46.3,54.3) | 0.27 | 1.21 (-1.03,3.45) |
| % Progressive Sperm Motility | 29.4 (27.5,31.3) | 27.7 (25.1,30.3) | 27.9 (25.7,30.1) | 29.8 (27.2,32.5) | 30.4 (27.7,33.2) | 0.27 | 0.78 (-0.76,2.31) |
| Motile Sperm Count (million) | 69.1 (57.5,83.0) | 54.8 (42.4,70.7) | 63.6 (51.5,78.4) | 55.3 (42.7,71.4) | 84.0 (64.4,110) | 0.16 | 8.60 (-6.29,25.6) |
| % Normal Sperm Morphology | 7.53 (7.03,8.02) | 6.47 (5.78,7.15) | 6.44 (5.88,7.00) | 6.57 (5.89,7.26) | 6.93 (6.22,7.65) | 0.45 | 0.12 (-0.28,0.52) |
| Morphologically Normal Sperm Count | 11.1 (9.43,13.0) | 8.87 (7.05,11.1) | 9.31 (7.71,11.2) | 8.5 (6.74,10.7) | 12.2 (9.65,15.3) | 0.36 | 7.63 (-4.40,21.2) |
| **Sperm DNA Damage** **(389 men/ 389 samples)** | 123 men / 123 semen samples | 55 men / 55 semen samples | 80 men / 80 semen samples | 60 men / 60 semen samples | 71 men / 71 semen samples |  |  |
| **Sperm DNA Damage (n=389 men, 389 samples)** |   |   |   |   |   |   |
| Comet Extent (μm) | 125(118, 132) | 127(117, 137) | 127(119, 135) | 130(121, 140) | 122(113, 130) | 0.52 | -1.21(-5.28, 3.05)  |
| Comet Tail DNA (%) | 29.5 (27.1,32.0) | 26.7 (23.6,30.3) | 28.9 (26.1,32.1) | 29.9 (26.5,33.7) | 28.3 (25.4,31.6) | 0.86 | -1.89 (-8.18,4.85)  |
| Comet Tail Distributed Moment (μm) | 57.0 (54.4,59.6) | 59.6 (55.7,63.5) | 57.9 (54.7,61.2) | 59.5 (55.7,63.2) | 56.5 (53.0,59.9) | 0.64 | -0.11 (-2.19,1.96)  |
| Comet Cells with high DNA damage (n) | 8 (6,10) | 10 (7,14) | 8 (6,11) | 10 (7,13) | 9 (7,12) | 0.72 | 0 (-14,16)  |
| **Reproductive Hormones**  **(405 men/ 405 samples)** | 129 men / 129 serum samples | 58 men / 58 serum samples | 83 men / 83 serum samples | 62 men / 62 serum samples | 73 men / 73 serum samples |  |  |
| Estradiol, pg/mL | 26.7 (24.5,29.1) | 30.3 (26.7,34.5) | 24.3 (21.8,27.1) | 26.9 (23.8,30.5) | 26.7 (23.8,30.0) | 0.86 | -1.52 (-7.92,5.32)  |
| Testosterone, ng/dL | 436 (-412, 460) | 478 (-443,514) | 385 (-355, 415) | 410 (-375, 444) | 417 (-385, 449) | 0.22 | -3.39 (-22.2,15.4)  |
| FAI | 54.9 (51.6,58.5) | 51.4 (46.8,56.4) | 52.7 (48.8,57.0) | 51.8 (47.3,56.7) | 55.7 (51.2,60.5) | 0.59 | 3.30 (-1.59,8.43)  |
| SHBG, nmol/L | 28.2 (26.2,30.2) | 32.8 (29.8,35.8) | 26.3 (23.8,28.8) | 28.5 (25.6,31.4) | 26.9 (24.3,29.6) | 0.22 | -1.02 (-2.59,0.55)  |
| FSH, IU/L | 7.17 (6.56,7.84) | 7.67 (6.71,8.77) | 8.16 (7.30,9.13) | 8.05 (7.08,9.16) | 7.33 (6.50,8.25) | 0.99 | -0.22 (-6.92,6.97)  |
| LH, IU/L | 9.49 (8.75,10.3) | 10.7 (9.45,12.04) | 9.39 (8.48,10.4) | 9.61 (8.54,10.8) | 9.44 (8.47,10.5) | 0.65 | 0.16 (-5.96,6.68)  |
| T/ LH Ratio | 1.48 (1.37,1.61) | 1.48 (1.31,1.67) | 1.36 (1.22,1.50) | 1.40 (1.24,1.57) | 1.47 (1.31,1.64) | 0.95 | -0.12 (-6.29,6.45)  |
| Inhibin-B, pg/mL | 162 (-149,175) | 155 (-138, 175) | 146 (-132, 162) | 134 (-119, 150) | 159 (-143, 177) | 0.82 | 1.94 (-4.28,8.57)  |
| Prolactin, ng/mL | 11.8 (10.9,12.8) | 11.5 (10.2,13.0) | 11.5 (10.4,12.7) | 10.4 (9.30,11.7) | 12.1 (10.9,13.5) | 0.78 | -0.86 (-6.83,5.49)  |

Abbreviations: CI; confidence interval, m; meter, n; number, FSH; Follicle Stimulating Hormone, LH; Luteinizing Hormone, FAI ; Free Androgen Index, and SHBG; Sex hormone-binding globulin.

1 Unadjusted means were estimated using linear mixed models for the semen quality parameters and linear regression models for the reproductive hormone concentrations.

2 All changes for hormones are presented as % change except for testosterone and SHBG as mean difference.

# Supplementary Table 4. Unadjusted associations between distance from residential address to nearest major roadway and sperm disomy parameters in 101 men (101 semen samples).

|  |  |
| --- | --- |
| **Distance to Nearest Major Roadway**  |  |
| **Unadjusted IRR of chromosol disomy (95% CI) 101 men/ 101 samples** | **<50 m,****n=29** | **50-99 m,****n=19** | **100-199 m,****n=21** | **200-399 m, n=10** | **≥400 m, n=22** | **P for trend** | **Unadjusted IRR of chromosol disomy per 500 m increase** |
|  **XX18** | 1.17 (0.65, 2.09) | 1.41 (0.74, 2.68) | 0.96 (0.46, 1.99) | 1.64 (0.82, 3.29) | Ref | 0.58 | 0.86 (0.67, 1.10) |
|  **YY18** | 0.88 (0.60, 1.29) | 0.87 (0.55, 1.37) | 1.18 (0.77, 1.80) | 1.39 (0.89, 2.18) | Ref | 0.51 | 1.02 (0.89, 1.17)  |
|  **XY18** | 0.63 (0.34, 1.15) | 0.80 (0.41, 1.55) | 0.83 (0.42, 1.64) | 0.42 (0.16, 1.12) | Ref | 0.19 | 1.06 (0.85, 1.31)  |
| **Total disomy** | 0.83 (0.56, 1.24) | 0.97 (0.62, 1.53) | 0.98 (0.62, 1.56) | 1.00 (0.60, 1.68) | Ref | 0.47 | 1.00 (0.86, 1.16)  |

Abbreviations: CI; confidence interval, m; meter, n; number of samples, P; p value.

IRR: incidence rate of chromosol dismoy by distance categories compared to incidence in the reference category (≥400 m).

# Supplementary Table 5. Adjusted cross-sectional associations between distance from residential address to nearest major roadway and semen quality parameters among 797 men (797 semen samples).

|  |  |  |  |
| --- | --- | --- | --- |
|   | **Categories of Distance to Nearest Major Roadway** |   |   |
| **Adjusted means (95% CI)1** | <50 m | 50-99 m | 100-199 m | 200-399 m | ≥400 m | P for trend | Adjusted change per 500m increase (95% CI)2 |
|  **Semen Quality Parameters (n=797 men, 797 semen samples)** |  |
| Ejaculate Volume (mL) | 2.61(2.43, 2.81) | 2.57(2.33, 2.83) | 2.67(2.47, 2.89) | 2.69(2.44, 2.97) | 2.46(2.22, 2.72) | 0.36 | -1.55(-6.81, 4.01)  |
| Sperm Concentration (million/mL) | 59.0(51.4, 67.8) | 57.3(47.7, 69.0) | 57.7(49.5, 67.2) | 50.5(41.9, 61.0) | 68.3(56.2, 83.0) | 0.28 | 4.21(-6.28, 15.86)  |
| Total Sperm Count (million) | 154(134, 178) | 147(122, 178) | 154(132, 180) | 136(112, 165) | 168(138, 205) | 0.55 | 2.59(-7.92, 14.31)  |
| % Total Sperm Motility | 48.7(45.7, 51.8) | 46.3(42.2, 50.3) | 46.8(43.4, 50.1) | 48.8(44.7, 53.0) | 49.8(45.6, 54.1) | 0.41 | 1.06(-1.26, 3.37)  |
| % Progressive Sperm Motility | 29.6(27.4, 31.7) | 28.5(25.7, 31.3) | 28.1(25.7, 30.4) | 30.1(27.3, 33.0) | 29.9(26.9, 32.9) | 0.57 | 0.57(-1.04, 2.18)  |
| Motile Sperm Count (million) | 68.3(56.3, 82.8) | 59.5(46.1, 76.9) | 62.7(50.7, 77.5) | 56.7(43.6, 73.6) | 76.0(58.0, 99.6) | 0.46 | 4.92(-9.42, 21.53)  |
| % Normal Sperm Morphology | 7.46(6.91, 8.01) | 6.33(5.6, 7.06) | 6.54(5.94, 7.15) | 6.55(5.81, 7.30) | 6.97(6.20, 7.74) | 0.63 | 0.21(-0.21, 0.63)  |
| Morphologically Normal Sperm Count | 11.8(10.1, 13.9) | 10.2(8.24, 12.5) | 10.2(8.58, 12.2) | 9.39(7.57, 11.6) | 12.0(9.60, 14.9) | 0.82 | 4.97(-6.95, 18.41)  |

Abbreviations: CI; confidence interval, m; meter, and n; number.

1 All models were adjusted for age, race, abstinence time, and census tract median income.

# Supplementary Table 6. Adjusted associations between distance from residential address to nearest major roadway and semen quality parameters and serum reproductive hormone concentrations in men with no history of reproductive diseases 1.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Categories of Distance to Nearest Major Roadway |  |  |
| Semen Quality Parameters  | <50 m | 50-99 m | 100-199 m | 200-399 m | ≥400 m | P for trend | Adjusted change per 500m increase (95% CI)2 |
|  **(542 men/ 885 samples)** | 169 men / 254 semen samples | 88 men / 149 semen samples | 123 men / 215 semen samples | 85 men / 141 semen samples | 77 men / 126 semen samples |  |  |
| Ejaculate Volume (mL) | 2.66(2.45, 2.89)  | 2.45(2.19, 2.74)  | 2.6(2.37, 2.86)  | 2.54(2.26, 2.85)  | 2.55(2.25, 2.88)  | 0.70 | 1.06(-5.82, 8.65)  |
| Sperm Concentration (million/mL) | 57.7(50.1, 66.6)  | 55.5(45.6, 67.6)  | 64.8(54.9, 76.4)  | 53.5(43.9, 65.3)  | 70.3(56.8, 86.9)  | 0.18 | 1.41(-10.42, 15.08)  |
| Total Sperm Count (million) | 153(132, 178)  | 136(111, 167)  | 169(142, 200)  | 136(111, 167)  | 178(143, 222)  | 0.30 | 2.38(-9.97, 16.65)  |
| % Total Sperm Motility | 47.6(44.3, 50.9) | 43.4(38.9, 47.9) | 49.3(45.5, 53.1) | 49.6(45, 54.2) | 48(43.1, 52.9) | 0.56 | 0.4(-2.5, 3.3)  |
| % Progressive Sperm Motility | 29(26.7, 31.2) | 25.9(22.8, 28.9) | 29.4(26.8, 32) | 30.8(27.7, 33.9) | 28.4(25.1, 31.8) | 0.75 | 0.28(-1.69, 2.24)  |
| Motile Sperm Count (million) | 67.5(54.9, 83) | 50.8(38.2, 67.5) | 72.4(57, 92) | 56.3(42.1, 75.1) | 75.6(55.6, 103) | 0.46 | 1.51(-15.21, 21.53)  |
| % Normal Sperm Morphology | 7.74(7.15, 8.33)  | 6.4(5.59, 7.2)  | 6.79(6.11, 7.47)  | 6.92(6.1, 7.74)  | 6.95(6.07, 7.83)  | 0.38 | -0.15(-0.67, 0.37)  |
| Morphologically Normal Sperm Count | 11.1(9.26, 13.4)  | 8.65(6.65, 11.2)  | 10.5(8.47, 13.0)  | 8.77(6.72, 11.4)  | 11.8(8.97, 15.5)  | 0.75 | 1.01(-13.06, 17.23)  |
| **Sperm DNA Damage (234 men/ 234 samples)** | 70 men / 70 semen samples | 34 men / 34 semen samples | 49 men / 49 semen samples | 40 men / 40 semen samples | 41 men / 41 semen samples |  |  |
| Comet Extent (μm) | 126(116, 138) | 133(119, 150) | 123(111, 135) | 134(120, 150) | 120(108, 134) | 0.41 | -3.71(-9.79, 2.78)  |
| Comet Tail DNA (%) | 30.3(26.4, 34.7) | 27.7(23.2, 33.2) | 26.1(22.4, 30.3) | 28.1(23.7, 33.4) | 25.3(21.5, 29.9) | 0.12 | -10.1(-18.7, -0.54)  |
| Comet Tail Distributed Moment (μm) | 56.8(52.5, 61) | 60.9(55.3, 66.5) | 56.8(52.1, 61.5) | 60.1(54.8, 65.4) | 55.4(50.3, 60.5) | 0.50 | -1.24(-4.39, 1.91)  |
| Comet Cells with high DNA damage (n) | 7(4, 10) | 11(7, 17) | 7(4, 10) | 8(5, 13) | 8(5, 12) | 0.93 | 0(-25.9, 28.4)  |
|  **Reproductive Hormones (247 men/ 247 samples)** | 78 men / 78 serum samples | 37 men / 37 serum samples | 51 men / 51 serum samples | 38 men / 38 serum samples | 43 men / 43 serum samples |  |  |
| Estradiol, pg/mL | 26.9(23.1, 31.5) | 29(24, 35.1) | 26.3(22.3, 31.1) | 25.8(21.2, 31.3) | 28.1(23.4, 33.7) | 0.83 | -3.68(-13.64, 7.44)  |
| Testosterone, ng/dL | 444(405, 483) | 485(437, 533) | 371(329, 414) | 400 (351, 449) | 405(359, 451) | 0.09 | -21.16(-49.7, 7.34)  |
| FAI | 53.1(47.6, 59.1) | 51.4(45, 58.8) | 54.1(48.2, 60.9) | 51.6(45, 59.2) | 54.2(47.7, 61.6) | 0.75 | 1(-6.43, 9.02)  |
| SHBG, nmol/L | 29.3(26, 32.6) | 33.4(29.4, 37.5) | 24.5(21, 28.1) | 27.7(23.5, 31.9) | 26.2(22.3, 30.1) | 0.09 | -1.93(-4.32, 0.45)  |
| FSH, IU/L | 6.13(5.26, 7.14) | 6.59(5.46, 7.95) | 6.77(5.75, 7.98) | 7(5.78, 8.48) | 6.36(5.32, 7.61) | 0.83 | 2.63(-7.83, 14.27)  |
| LH, IU/L | 9.53(8.27, 11.0) | 10(8.36, 11.85) | 9.17(7.86, 10.69) | 9.73(8.14, 11.6) | 10.2(8.65, 12.1) | 0.42 | 5.7(-4.36, 16.81)  |
| T/ LH Ratio | 1.54(1.34, 1.78) | 1.65(1.39, 1.97) | 1.35(1.16, 1.57) | 1.36(1.14, 1.63) | 1.32(1.12, 1.56) | 0.05 | -9.63(-18.3, -0.07)  |
| Inhibin-B, pg/mL | 181(158, 207) | 175(149, 207) | 172(149, 199) | 147(124, 175) | 168(143, 197) | 0.30 | -3.62(-12.47, 6.13)  |
| Prolactin, ng/mL | 10.8(9.3, 12.4) | 10.1(8.4, 12) | 11.4(9.8, 13.4) | 10.2(8.5, 12.3) | 12(10.1, 14.2) | 0.22 | 1.35(-8.52, 12.29)  |

Abbreviations: CI; confidence interval, m; meter, P; p value, n; number, FSH; Follicle Stimulating Hormone, LH; Luteinizing Hormone, FAI; Free Androgen Index, and SHBG; Sex hormone-binding globulin.

1 Groin injury, testes not always in scrotum, varicocele, testicular torsion, testicular injury, hernia, epididymitis, prostatitis and seminal vesicle infection.

2 Adjusted means were estimated using linear mixed models for the semen quality parameters and linear regression models for the reproductive hormone concentrations. All models were adjusted for age, race, abstinence time, and census tract median income.

3 All changes for hormones are presented as % change except for testosterone and SHBG as mean difference.