TABLE 12-11. (continued)

## Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| Involun- tarily Falling Asleep During the Day | Officer | n | 128 | 121 | 124 | Overall<br>M vs. L<br>H vs. L | <br>****<br>**** | ****<br>****<br>**** |
| | Enlisted Flyer | n | 53 | 62 | 50 | Overall<br>M vs. L<br>H vs. L | <br>2.46 (0.35,17.51)<br>3.62 (0.50,26.04) | 0.390<br>0.368<br>0.202 |
| | Enlisted Groundcrew | n | 141 | 155 | 133 | Overall<br>M vs. L<br>H vs. L | <br>0.56 (0.17,1.77)**<br>0.49 (0.14,1.69)** | 0.436**<br>0.322**<br>0.257** |
| Great or Disabling Fatigue During the Day | Officer | n | 128 | 121 | 124 | Overall<br>M vs. L<br>H vs. L | <br>****<br>**** | ****<br>****<br>**** |
| | Enlisted Flyer | n | 53 | 62 | 50 | Overall<br>M vs. L<br>H vs. L | <br>2.37 (0.03,205.6)**<br>8.08 (0.13,505.5)** | 0.432**<br>0.704**<br>0.322** |
| | Enlisted Groundcrew | n | 141 | 155 | 133 | Overall<br>M vs. L<br>H vs. L | <br>0.60 (0.23,1.53)<br>0.31 (0.09,1.00) | 0.108<br>0.286<br>0.050 |

TABLE 12-11. (continued)

## Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|----------|-----------|-----------|-----|--------|------|------------------------|-------------------------------|---------|
| | | | Low | Medium | High | | | |
| Frightening Dreams | Officer | n | 128 | 121 | 124 | Overall | | **** |
| | | | | | | M vs. L | **** | **** |
| | | | | | | H vs. L | **** | **** |
| | Enlisted Flyer | n | 53 | 62 | 50 | Overall | | 0.974 |
| | | | | | | M vs. L | 1.03 (0.09,12.13) | 0.979 |
| | | | | | | H vs. L | 0.78 (0.05,12.86) | 0.863 |
| | Enlisted Groundcrew | n | 140 | 155 | 132 | Overall | | **** |
| | | | | | | M vs. L | **** | **** |
| | | | | | | H vs. L | **** | **** |
| Talking in Sleep | Officer | n | 128 | 121 | 124 | Overall | | 0.468** |
| | | | | | | M vs. L | 0.74 (0.15,3.61)** | 0.710** |
| | | | | | | H vs. L | 1.68 (0.44,6.36)** | 0.444** |
| | Enlisted Flyer | n | 53 | 62 | 50 | Overall | | 0.941** |
| | | | | | | M vs. L | 1.40 (0.13,14.64)** | 0.779** |
| | | | | | | H vs. L | 0.96 (0.06,14.35)** | 0.975** |
| | Enlisted Groundcrew | n | 141 | 155 | 132 | Overall | | 0.212 |
| | | | | | | M vs. L | 1.12 (0.45,2.82) | 0.802 |
| | | | | | | H vs. L | 0.42 (0.12,1.46) | 0.172 |

TABLE 12-11. (continued)

## Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| Sleep-walking | Officer | n | 128 | 121 | 124 | Overall | | 0.471** |
| | | | | | | M vs. L | 3.73 (0.35,39.92)** | 0.277** |
| | | | | | | H vs. L | 3.21 (0.29,35.75)** | 0.343** |
| | Enlisted Flyer | n | 53 | 62 | 50 | Overall | | 0.798 |
| | | | | | | M vs. L | 1.93 (0.03,107.13) | 0.747 |
| | | | | | | H vs. L | 3.51 (0.07,176.30) | 0.530 |
| | Enlisted Groundcrew | n | 141 | 155 | 133 | Overall | | 0.617 |
| | | | | | | M vs. L | 2.24 (0.42,11.92) | 0.346 |
| | | | | | | H vs. L | 1.64 (0.27,10.09) | 0.595 |
| Abnormal Movement/ Activity During the Night | Officer | n | 128 | 121 | 124 | Overall | | 0.607** |
| | | | | | | M vs. L | 2.43 (0.19,31.28)** | 0.496** |
| | | | | | | H vs. L | 3.23 (0.27,38.06)** | 0.352** |
| | Enlisted Flyer | n | 53 | 62 | 50 | Overall | | 0.231 |
| | | | | | | M vs. L | 0.37 (0.03,4.29) | 0.429 |
| | | | | | | H vs. L | -- | 0.747 |
| | Enlisted Groundcrew | n | 141 | 155 | 133 | Overall | | 0.316 |
| | | | | | | M vs. L | 0.53 (0.20,1.44) | 0.214 |
| | | | | | | H vs. L | 0.49 (0.16,1.46) | 0.199 |

TABLE 12-11. (continued)

Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| Sleep Problems Requiring Medication | Officer | n | 128 | 121 | 124 | Overall | | 0.597 |
| | | | | | | M vs. L | 2.00 (0.17,23.34) | 0.581 |
| | | | | | | H vs. L | 3.11 (0.30,31.96) | 0.340 |
| | Enlisted Flyer | n | 53 | 62 | 50 | Overall | | 0.999 |
| | | | | | | M vs. L | -- | 0.993 |
| | | | | | | H vs. L | -- | 0.980 |
| | Enlisted Groundcrew | n | 141 | 155 | 133 | Overall | | 0.422 |
| | | | | | | M vs. L | 0.40 (0.10,1.69) | 0.215 |
| | | | | | | H vs. L | 0.81 (0.22,3.05) | 0.757 |
| Snore Loudly in All Sleeping Positions | Officer | n | 128 | 121 | 124 | Overall | | 0.083 |
| | | | | | | M vs. L | 0.88 (0.23,3.40) | 0.850 |
| | | | | | | H vs. L | 2.58 (0.84,7.93) | 0.097 |
| | Enlisted Flyer | n | 53 | 62 | 50 | Overall | | 0.295 |
| | | | | | | M vs. L | 1.41 (0.22,8.94) | 0.718 |
| | | | | | | H vs. L | 3.48 (0.61,19.80) | 0.161 |
| | Enlisted Groundcrew | n | 141 | 155 | 133 | Overall | | 0.119** |
| | | | | | | M vs. L | 2.64 (0.99,7.01)** | 0.052** |
| | | | | | | H vs. L | 1.99 (0.71,5.58)** | 0.189** |

TABLE 12-11. (continued)

## Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| Insomnia | Officer | n | 128 | 121 | 124 | Overall | | 0.108 |
| | | | | | | M vs. L | 0.81 (0.41,1.60) | 0.548 |
| | | | | | | H vs. L | 1.56 (0.84,2.88) | 0.159 |
| | Enlisted Flyer | n | 53 | 62 | 50 | Overall | | 0.701** |
| | | | | | | M vs. L | 1.45 (0.56,3.76)** | 0.444** |
| | | | | | | H vs. L | 1.43 (0.52,3.95)** | 0.484** |
| | Enlisted Groundcrew | n | 141 | 155 | 133 | Overall | | 0.397 |
| | | | | | | M vs. L | 1.09 (0.65,1.83) | 0.750 |
| | | | | | | H vs. L | 0.75 (0.42,1.32) | 0.321 |
| Overall Sleep Disorder Index | Officer | n | 128 | 121 | 124 | Overall | | 0.069** |
| | | | | | | M vs. L | 1.04 (0.58,1.88)** | 0.894** |
| | | | | | | H vs. L | 1.81 (1.02,3.20)** | 0.043** |
| | Enlisted Flyer | n | 53 | 62 | 50 | Overall | | **** |
| | | | | | | M vs. L | **** | **** |
| | | | | | | H vs. L | **** | **** |
| | Enlisted Groundcrew | n | 140 | 155 | 132 | Overall | | 0.675 |
| | | | | | | M vs. L | 1.22 (0.75,1.97) | 0.419 |
| | | | | | | H vs. L | 1.02 (0.62,1.68) | 0.927 |

TABLE 12-11. (continued)

## Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| Average Sleep Each Night | Officer | n | 128 | 121 | 124 | Overall | | 0.829** |
| | | Adj. Mean** | 6.82 | 6.87 | 6.89 | M vs. L | -- | 0.695** |
| | | 95% C.I.** | (6.43,7.21) | (6.48,7.25) | (6.51,7.27) | H vs. L | -- | 0.547** |
| | Enlisted Flyer | n | 53 | 62 | 50 | Overall | | **** |
| | | Adj. Mean | **** | **** | **** | M vs. L | -- | **** |
| | | 95% C.I. | **** | **** | **** | H vs. L | -- | **** |
| | Enlisted Groundcrew | n | 141 | 155 | 133 | Overall | | 0.960** |
| | | Adj. Mean** | 6.62 | 6.62 | 6.66 | M vs. L | -- | 0.989** |
| | | 95% C.I.** | (6.39,6.86) | (6.38,6.86) | (6.41,6.90) | H vs. L | -- | 0.810** |
| SCL-90-R Anxiety | Officer | n | 107 | 101 | 109 | Overall | | 0.960 |
| | | | | | | M vs. L | 0.82 (0.12,5.39) | 0.835 |
| | | | | | | H vs. L | 0.77 (0.11,5.22) | 0.788 |
| | Enlisted Flyer | n | 48 | 53 | 45 | Overall | | 0.022 |
| | | | | | | M vs. L | -- | -- |
| | | | | | | H vs. L | -- | -- |
| | Enlisted Groundcrew | n | 127 | 142 | 122 | Overall | | 0.589 |
| | | | | | | M vs. L | 0.66 (0.29,1.50) | 0.323 |
| | | | | | | H vs. L | 0.75 (0.33,1.68) | 0.481 |

TABLE 12-11. (continued)

## Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| SCL-90-R Depression | Officer | n | 107 | 101 | 109 | Overall | | 0.128 |
| | | | | | | M vs. L | 2.88 (0.47,17.77) | 0.254 |
| | | | | | | H vs. L | 4.72 (0.90,24.88) | 0.067 |
| | Enlisted Flyer | n | 48 | 53 | 45 | Overall | | 0.719** |
| | | | | | | M vs. L | 1.52 (0.33,7.05)** | 0.594** |
| | | | | | | H vs. L | 1.84 (0.40,8.45)** | 0.430** |
| | Enlisted Groundcrew | n | 127 | 142 | 122 | Overall | | 0.276 |
| | | | | | | M vs. L | 0.74 (0.36,1.52) | 0.412 |
| | | | | | | H vs. L | 0.52 (0.23,1.17) | 0.115 |
| SCL-90-R Hostility | Officer | n | 107 | 101 | 109 | Overall | | 0.002 |
| | | | | | | M vs. L | -- | -- |
| | | | | | | H vs. L | -- | -- |
| | Enlisted Flyer | n | 48 | 53 | 45 | Overall | | 0.250 |
| | | | | | | M vs. L | 0.28 (0.03,2.89) | 0.287 |
| | | | | | | H vs. L | 1.54 (0.32,7.44) | 0.594 |
| | Enlisted Groundcrew | n | 127 | 142 | 122 | Overall | | 0.922 |
| | | | | | | M vs. L | 1.24 (0.43,3.58) | 0.688 |
| | | | | | | H vs. L | 1.12 (0.34,3.68) | 0.851 |

**TABLE** 12-11. (continued)

## Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| SCL–90–R Inter-personal Sensitivity | Officer | n | 107 | 101 | 109 | Overall | | 0.138 |
| | | | | | | M vs. L | 1.35 (0.06,30.13) | 0.848 |
| | | | | | | H vs. L | 7.34 (0.62,87.59) | 0.115 |
| | Enlisted Flyer | n | 48 | 53 | 45 | Overall | | 0.528 |
| | | | | | | M vs. L | 2.61 (0.46,14.92) | 0.280 |
| | | | | | | H vs. L | 1.68 (0.26,11.08) | 0.587 |
| | Enlisted Groundcrev | n | 127 | 142 | 122 | Overall | | 0.637 |
| | | | | | | M vs. L | 0.95 (0.40,2.28) | 0.911 |
| | | | | | | H vs. L | 0.65 (0.25,1.71) | 0.382 |
| SCL–90–R Obsessive-Compulsive Behavior | Officer | n | 107 | 101 | 109 | Overall | | 0.893 |
| | | | | | | M vs. L | 0.93 (0.12,7.48) | 0.946 |
| | | | | | | H vs. L | 1.42 (0.21,9.64) | 0.722 |
| | Enlisted Flyer | n | 48 | 53 | 45 | Overall | | **** |
| | | | | | | M vs. L | **** | **** |
| | | | | | | H vs. L | **** | **** |
| | Enlisted Groundcrev | n | 127 | 142 | 122 | Overall | | 0.248 |
| | | | | | | M vs. L | 0.53 (0.25,1.13) | 0.102 |
| | | | | | | H vs. L | 0.81 (0.39,1.67) | 0.565 |

TABLE 12-11. (continued)

## Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| SCL-90-R Paranoid Ideation | Officer | n | 107 | 101 | 109 | Overall | | 0.013 |
| | | | | | | M vs. L | -- | -- |
| | | | | | | H vs. L | -- | -- |
| | Enlisted Flyer | n | 48 | 53 | 45 | Overall | | 0.053 |
| | | | | | | M vs. L | -- | -- |
| | | | | | | H vs. L | 3.77 (0.31,45.43) | 0.296 |
| | Enlisted Groundcrew | n | 127 | 142 | 122 | Overall | | 0.174 |
| | | | | | | M vs. L | 0.57 (0.22,1.49) | 0.252 |
| | | | | | | H vs. L | 0.35 (0.11,1.15) | 0.085 |
| SCL-90-R Phobic Anxiety | Officer | n | 107 | 101 | 109 | Overall | | 0.926 |
| | | | | | | M vs. L | 1.13 (0.14,9.39) | 0.907 |
| | | | | | | H vs. L | 1.52 (0.18,13.04) | 0.702 |
| | Enlisted Flyer | n | 48 | 53 | 45 | Overall | | **** |
| | | | | | | M vs. L | **** | **** |
| | | | | | | H vs. L | **** | **** |
| | Enlisted Groundcrew | n | 127 | 142 | 122 | Overall | | 0.176 |
| | | | | | | M vs. L | 0.57 (0.24,1.34) | 0.200 |
| | | | | | | H vs. L | 0.44 (0.17,1.10) | 0.080 |

TABLE 12-11. (continued)

Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| SCL-90-R Psychoticism | Officer | n | 107 | 101 | 109 | Overall<br>M vs. L<br>H vs. L | <br>1.63 (0.13,19.92)<br>9.91 (1.17,84.22) | 0.007<br>0.701<br>0.036 |
| | Enlisted Flyer | n | 48 | 53 | 45 | Overall<br>M vs. L<br>H vs. L | <br>****<br>**** | ****<br>****<br>**** |
| | Enlisted Groundcrew | n | 127 | 142 | 122 | Overall<br>M vs. L<br>H vs. L | <br>0.99 (0.47,2.06)<br>0.76 (0.34,1.69) | 0.753<br>0.970<br>0.502 |
| SCL-90-R Somatization | Officer | n | 107 | 101 | 109 | Overall<br>M vs. L<br>H vs. L | <br>0.36 (0.06,1.98)<br>1.25 (0.37,4.21) | 0.252<br>0.238<br>0.720 |
| | Enlisted Flyer | n | 48 | 53 | 45 | Overall<br>M vs. L<br>H vs. L | <br>1.03 (0.31,3.45)<br>1.04 (0.30,3.58) | 0.998<br>0.963<br>0.954 |
| | Enlisted Groundcrew | n | 127 | 142 | 122 | Overall<br>M vs. L<br>H vs. L | <br>0.79 (0.39,1.63)<br>0.71 (0.33,1.50) | 0.644<br>0.530<br>0.363 |

TABLE 12–11. (continued)

## Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| SCL–90–R GSI | Officer | n | 107 | 101 | 109 | Overall | | **** |
| | | | | | | M vs. L | **** | **** |
| | | | | | | H vs. L | **** | **** |
| | Enlisted Flyer | n | 48 | 53 | 45 | Overall | | 0.781 |
| | | | | | | M vs. L | 1.81 (0.30,10.81) | 0.515 |
| | | | | | | H vs. L | 1.68 (0.26,10.86) | 0.586 |
| | Enlisted Groundcrew | n | 127 | 142 | 122 | Overall | | 0.669 |
| | | | | | | M vs. L | 0.82 (0.40,1.67) | 0.582 |
| | | | | | | H vs. L | 0.71 (0.33,1.53) | 0.379 |
| SCL–90–R PSDI | Officer | n | 107 | 101 | 109 | Overall | | 0.599 |
| | | | | | | M vs. L | 1.80 (0.52,6.23) | 0.351 |
| | | | | | | H vs. L | 1.67 (0.49,5.77) | 0.415 |
| | Enlisted Flyer | n | 48 | 53 | 45 | Overall | | 0.937 |
| | | | | | | M vs. L | 1.09 (0.29,4.13) | 0.898 |
| | | | | | | H vs. L | 1.17 (0.30,4.49) | 0.821 |
| | Enlisted Groundcrew | n | 127 | 142 | 122 | Overall | | 0.947** |
| | | | | | | M vs. L | 0.88 (0.41,1.90)** | 0.742** |
| | | | | | | H vs. L | 0.93 (0.42,2.05)** | 0.859** |

TABLE 12-11. (continued)

Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| SCL-90-R PST | Officer | n | 107 | 101 | 109 | Overall | | 0.271** |
| | | | | | | M vs. L | 0.44 (0.03,5.97)** | 0.537** |
| | | | | | | H vs. L | 2.36 (0.35,15.85)** | 0.376** |
| | Enlisted Flyer | n | 48 | 53 | 45 | Overall | | 0.747** |
| | | | | | | M vs. L | 1.84 (0.31,11.09)** | 0.504** |
| | | | | | | H vs. L | 1.07 (0.14,8.23)** | 0.947** |
| | Enlisted Groundcrew | n | 127 | 142 | 122 | Overall | | 0.631 |
| | | | | | | M vs. L | 0.72 (0.34,1.52) | 0.395 |
| | | | | | | H vs. L | 0.73 (0.34,1.59) | 0.431 |
| MCMI Schizoid Score | Officer | n | 128 | 121 | 124 | Overall | | 0.262 |
| | | Adj. Mean[a] | 20.8 | 20.1 | 22.4 | M vs. L | -- | 0.597 |
| | | 95% C.I.[a] | (16.5,26.2) | (16.0,25.2) | (17.9,28.1) | H vs. L | -- | 0.284 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.158 |
| | | Adj. Mean[a] | 19.2 | 23.2 | 19.3 | M vs. L | -- | 0.095 |
| | | 95% C.I.[a] | (14.8,25.0) | (18.2,29.4) | (15.0,24.9) | H vs. L | -- | 0.963 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.473** |
| | | Adj. Mean**[a] | 24.3 | 25.6 | 23.5 | M vs. L | -- | 0.453** |
| | | 95% C.I.**[a] | (21.5,27.5) | (22.6,29.0) | (20.7,26.8) | H vs. L | -- | 0.640** |

TABLE 12-11. (continued)

Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| MCMI Avoidant Score | Officer | n | 128 | 121 | 124 | Overall | | 0.731 |
| | | Adj. Mean[b] | 13.5 | 12.7 | 13.9 | M vs. L | -- | 0.605 |
| | | 95% C.I.[b] | (9.2,19.8) | (8.7,18.5) | (9.5,20.2) | H vs. L | -- | 0.798 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.245 |
| | | Adj. Mean[b] | 10.1 | 13.3 | 11.6 | M vs. L | -- | 0.095 |
| | | 95% C.I.[b] | (6.8,14.9) | (9.4,18.9) | (7.9,16.8) | H vs. L | -- | 0.426 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.310 |
| | | Adj. Mean[b] | 16.6 | 19.1 | 18.6 | M vs. L | -- | 0.149 |
| | | 95% C.I.[b] | (13.9,19.8) | (16.0,22.7) | (15.5,22.3) | H vs. L | -- | 0.249 |
| MCMI Dependent Score | Officer | n | 128 | 121 | 124 | Overall | | 0.313** |
| | | Adj. Mean**[c] | 44.6 | 40.9 | 43.1 | M vs. L | -- | 0.131** |
| | | 95% C.I.**[c] | (35.4,54.8) | (32.1,50.8) | (33.9,53.3) | H vs. L | -- | 0.554** |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.891 |
| | | Adj. Mean[c] | 43.6 | 41.9 | 43.4 | M vs. L | -- | 0.661 |
| | | 95% C.I.[c] | (30.2,59.6) | (29.9,55.9) | (30.3,58.8) | H vs. L | -- | 0.950 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.356 |
| | | Adj. Mean[c] | 51.7 | 53.7 | 55.7 | M vs. L | -- | 0.466 |
| | | 95% C.I.[c] | (44.1,60.0) | (45.6,62.5) | (47.7,64.4) | H vs. L | -- | 0.151 |

TABLE 12-11. (continued)

## Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| MCMI Histrionic Score | Officer | n | 128 | 121 | 124 | Overall | | 0.869** |
| | | Adj. Mean**[d] | 61.6 | 61.6 | 62.4 | M vs. L | -- | 0.982** |
| | | 95% C.I.**[d] | (54.2,68.2) | (54.0,68.3) | (55.1,69.0) | H vs. L | -- | 0.657** |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.973 |
| | | Adj. Mean[d] | 66.5 | 66.1 | 66.6 | M vs. L | -- | 0.861 |
| | | 95% C.I.[d] | (60.3,72.1) | (60.5,71.2) | (60.8,71.8) | H vs. L | -- | 0.967 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | **** |
| | | Adj. Mean[d] | **** | **** | **** | M vs. L | -- | **** |
| | | 95% C.I.[d] | **** | **** | **** | H vs. L | -- | **** |
| MCMI Narcissistic Score | Officer | n | 128 | 121 | 124 | Overall | | 0.855 |
| | | Adj. Mean | 66.3 | 66.1 | 67.1 | M vs. L | -- | 0.880 |
| | | 95% C.I. | (60.2,72.5) | (60.1,72.1) | (61.1,73.0) | H vs. L | -- | 0.698 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.826 |
| | | Adj. Mean | 68.3 | 66.9 | 66.6 | M vs. L | -- | 0.619 |
| | | 95% C.I. | (61.5,75.2) | (60.6,73.1) | (59.9,73.2) | H vs. L | -- | 0.569 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | **** |
| | | Adj. Mean | **** | **** | **** | M vs. L | -- | **** |
| | | 95% C.I. | **** | **** | **** | H vs. L | -- | **** |

TABLE 12-11. (continued)

Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| MCMI Antisocial Score | Officer | n | 128 | 121 | 124 | Overall | | 0.729 |
| | | Adj. Mean | 60.7 | 62.2 | 62.4 | M vs. L | -- | 0.524 |
| | | 95% C.I. | (53.2,68.2) | (54.8,69.5) | (55.0,69.7) | H vs. L | -- | 0.464 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.589 |
| | | Adj. Mean | 57.3 | 61.2 | 58.9 | M vs. L | -- | 0.308 |
| | | 95% C.I. | (48.3,66.3) | (53.0,69.4) | (50.2,67.6) | H vs. L | -- | 0.683 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.525 |
| | | Adj. Mean | 61.8 | 63.3 | 60.6 | M vs. L | -- | 0.526 |
| | | 95% C.I. | (57.7,66.0) | (59.1,67.5) | (56.3,65.0) | H vs. L | -- | 0.613 |
| MCMI Compulsive Score | Officer | n | 128 | 121 | 124 | Overall | | 0.490 |
| | | Adj. Mean[d] | 71.7 | 70.8 | 70.7 | M vs. L | -- | 0.310 |
| | | 95% C.I.[d] | (68.6,74.7) | (67.6,73.8) | (67.6,73.7) | H vs. L | -- | 0.291 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.727 |
| | | Adj. Mean[d] | 70.1 | 68.9 | 69.5 | M vs. L | -- | 0.426 |
| | | 95% C.I.[d] | (66.6,73.5) | (65.7,72.1) | (66.0,72.7) | H vs. L | -- | 0.661 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.394 |
| | | Adj. Mean[d] | 67.9 | 68.8 | 69.4 | M vs. L | -- | 0.403 |
| | | 95% C.I.[d] | (66.0,69.8) | (66.9,70.7) | (67.4,71.3) | H vs. L | -- | 0.177 |

TABLE 12-11. (continued)

Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| MCMI Passive-Aggressive Score | Officer | n | 128 | 121 | 124 | Overall | | 0.798 |
| | | Adj. Mean[c] | 15.1 | 14.4 | 15.3 | M vs. L | -- | 0.636 |
| | | 95% C.I.[c] | (10.5,20.4) | (10.0,19.5) | (10.9,20.5) | H vs. L | -- | 0.863 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.140 |
| | | Adj. Mean[c] | 11.9 | 16.2 | 15.8 | M vs. L | -- | 0.067 |
| | | 95% C.I.[c] | (7.4,17.5) | (11.3,22.0) | (10.7,22.0) | H vs. L | -- | 0.111 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.667 |
| | | Adj. Mean[c] | 22.7 | 22.7 | 21.1 | M vs. L | -- | 0.983 |
| | | 95% C.I.[c] | (19.1,26.5) | (19.1,26.6) | (17.5,24.9) | H vs. L | -- | 0.440 |
| MCMI Schizotypal Score | Officer | n | 128 | 121 | 124 | Overall | | 0.506 |
| | | Adj. Mean | 33.1 | 30.7 | 32.8 | M vs. L | -- | 0.280 |
| | | 95% C.I. | (25.1,41.2) | (22.8,38.5) | (24.8,40.7) | H vs. L | -- | 0.873 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.959 |
| | | Adj. Mean | 29.4 | 30.5 | 30.0 | M vs. L | -- | 0.772 |
| | | 95% C.I. | (16.7,42.1) | (19.0,42.0) | (17.5,42.5) | H vs. L | -- | 0.873 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.476 |
| | | Adj. Mean | 38.9 | 41.0 | 41.5 | M vs. L | -- | 0.347 |
| | | 95% C.I. | (33.3,44.5) | (35.2,46.8) | (36.0,47.0) | H vs. L | -- | 0.254 |

TABLE 12-11. (continued)

Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| MCMI Borderline Score | Officer | n | 128 | 121 | 124 | Overall | | **** |
| | | Adj. Mean | **** | **** | **** | M vs. L | -- | **** |
| | | 95% C.I. | **** | **** | **** | H vs. L | -- | **** |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.299 |
| | | Adj. Mean | 36.5 | 34.0 | 31.5 | M vs. L | -- | 0.418 |
| | | 95% C.I. | (25.9,47.1) | (24.5,43.6) | (21.1,41.9) | H vs. L | -- | 0.121 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | **** |
| | | Adj. Mean | **** | **** | **** | M vs. L | -- | **** |
| | | 95% C.I. | **** | **** | **** | H vs. L | -- | **** |
| MCMI Paranoid Score | Officer | n | 128 | 121 | 124 | Overall | | 0.915 |
| | | Adj. Mean | 54.5 | 53.8 | 53.1 | M vs. L | -- | 0.706 |
| | | 95% C.I. | (48.2,60.8) | (47.6,59.9) | (47.7,59.9) | H vs. L | -- | 0.726 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.708** |
| | | Adj. Mean** | 55.7 | 53.2 | 53.9 | M vs. L | -- | 0.416** |
| | | 95% C.I.** | (48.6,62.7) | (46.8,59.7) | (47.1,60.7) | H vs. L | -- | 0.577** |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.153 |
| | | Adj. Mean | 55.1 | 58.6 | 57.0 | M vs. L | -- | 0.053 |
| | | 95% C.I. | (51.9,58.4) | (55.3,61.8) | (53.6,60.4) | H vs. L | -- | 0.308 |

TABLE 12-11. (continued)

Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| MCMI Anxiety Score | Officer | n | 128 | 121 | 124 | Overall | | 0.425 |
| | | Adj. Mean | 50.1 | 48.4 | 51.8 | M vs. L | -- | 0.513 |
| | | 95% C.I. | (41.5,58.7) | (40.0,56.8) | (43.4,60.2) | H vs. L | -- | 0.517 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.490 |
| | | Adj. Mean | 46.0 | 46.9 | 50.5 | M vs. L | -- | 0.820 |
| | | 95% C.I. | (37.1,55.0) | (38.7,55.0) | (41.9,59.2) | H vs. L | -- | 0.263 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.909 |
| | | Adj. Mean | 51.0 | 50.0 | 50.9 | M vs. L | -- | 0.689 |
| | | 95% C.I. | (46.3,55.7) | (45.3,54.6) | (46.0,55.7) | H vs. L | -- | 0.964 |
| MCMI Somatoform Score | Officer | n | 128 | 121 | 124 | Overall | | 0.455 |
| | | Adj. Mean | 53.2 | 51.1 | 50.8 | M vs. L | -- | 0.311 |
| | | 95% C.I. | (46.2,60.3) | (44.1,58.0) | (43.9,57.7) | H vs. L | -- | 0.250 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.648 |
| | | Adj. Mean | 55.0 | 52.1 | 53.4 | M vs. L | -- | 0.353 |
| | | 95% C.I. | (47.6,62.4) | (45.4,58.8) | (46.3,60.6) | H vs. L | -- | 0.628 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.959** |
| | | Adj. Mean** | 54.9 | 54.5 | 54.3 | M vs. L | -- | 0.855** |
| | | 95% C.I.** | (51.1,58.7) | (50.7,58.3) | (50.3,58.2) | H vs. L | -- | 0.775** |

TABLE 12-11. (continued)

Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| MCMI Hypomania Score | Officer | n | 128 | 121 | 124 | Overall | | 0.618 |
| | | Adj. Mean[c] | 18.4 | 20.8 | 20.9 | M vs. L | -- | 0.407 |
| | | 95% C.I.[c] | (10.3,28.8) | (12.3,31.6) | (12.4,31.6) | H vs. L | -- | 0.384 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.859 |
| | | Adj. Mean[c] | 28.0 | 28.4 | 31.0 | M vs. L | -- | 0.939 |
| | | 95% C.I.[c] | (16.5,42.5) | (17.7,41.6) | (19.2,45.7) | H vs. L | -- | 0.613 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.364 |
| | | Adj. Mean[c] | 31.0 | 26.3 | 28.3 | M vs. L | -- | 0.157 |
| | | 95% C.I.[c] | (25.1,37.6) | (20.9,32.5) | (22.4,34.8) | H vs. L | -- | 0.430 |
| MCMI Dysthymia Score | Officer | n | 128 | 121 | 124 | Overall | | 0.407 |
| | | Adj. Mean | 57.8 | 54.4 | 54.7 | M vs. L | -- | 0.223 |
| | | 95% C.I. | (48.4,67.3) | (45.2,63.6) | (45.6,63.9) | H vs. L | -- | 0.273 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.866 |
| | | Adj. Mean | 47.1 | 46.0 | 48.2 | M vs. L | -- | 0.780 |
| | | 95% C.I. | (37.6,56.6) | (37.3,54.7) | (39.0,57.4) | H vs. L | -- | 0.805 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.717 |
| | | Adj. Mean | 51.9 | 50.3 | 49.9 | M vs. L | -- | 0.529 |
| | | 95% C.I. | (47.2,56.7) | (45.5,55.1) | (44.9,54.8) | H vs. L | -- | 0.447 |

TABLE 12-11. (continued)

## Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| MCMI Alcohol Abuse Score | Officer | n | 128 | 121 | 124 | Overall | | **** |
| | | Adj. Mean | **** | **** | **** | M vs. L | -- | **** |
| | | 95% C.I. | **** | **** | **** | H vs. L | -- | **** |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.805 |
| | | Adj. Mean | 35.8 | 34.4 | 36.2 | M vs. L | -- | 0.639 |
| | | 95% C.I. | (28.8,42.7) | (28.1,40.6) | (29.5,42.9) | H vs. L | -- | 0.878 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.843 |
| | | Adj. Mean | 37.8 | 37.5 | 36.6 | M vs. L | -- | 0.881 |
| | | 95% C.I. | (34.2,41.3) | (33.9,41.0) | (33.0,40.3) | H vs. L | -- | 0.572 |
| MCMI Drug Abuse Score | Officer | n | 128 | 121 | 124 | Overall | | 0.357 |
| | | Adj. Mean | 49.2 | 46.0 | 49.0 | M vs. L | -- | 0.202 |
| | | 95% C.I. | (41.1,57.3) | (38.1,54.0) | (41.1,56.9) | H vs. L | -- | 0.937 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.836 |
| | | Adj. Mean | 55.4 | 54.3 | 56.6 | M vs. L | -- | 0.768 |
| | | 95% C.I. | (46.6,64.2) | (46.4,62.3) | (48.1,65.1) | H vs. L | -- | 0.769 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | **** |
| | | Adj. Mean | **** | **** | **** | M vs. L | -- | **** |
| | | 95% C.I. | **** | **** | **** | H vs. L | -- | **** |

TABLE 12-11. (continued)

Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| MCMI Psychotic Thinking Score | Officer | n | 128 | 121 | 124 | Overall | | 0.462 |
| | | Adj. Mean | 21.1 | 19.8 | 22.8 | M vs. L | -- | 0.596 |
| | | 95% C.I. | (12.9,29.3) | (11.7,27.8) | (14.8,30.8) | H vs. L | -- | 0.482 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.389** |
| | | Adj. Mean** | 26.2 | 30.8 | 30.8 | M vs. L | -- | 0.224** |
| | | 95% C.I.** | (17.5,35.0) | (22.8,38.7) | (22.4,39.3) | H vs. L | -- | 0.241** |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.334** |
| | | Adj. Mean** | 35.0 | 37.2 | 38.5 | M vs. L | -- | 0.343** |
| | | 95% C.I.** | (30.8,39.2) | (33.0,41.4) | (34.1,42.9) | H vs. L | -- | 0.145** |
| MCMI Psychotic Depression Score | Officer | n | 128 | 121 | 124 | Overall | | 0.392 |
| | | Adj. Mean | 17.8 | 15.5 | 15.0 | M vs. L | -- | 0.297 |
| | | 95% C.I. | (10.5,25.2) | (8.3,22.7) | (7.8,22.2) | H vs. L | -- | 0.197 |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.844 |
| | | Adj. Mean | 26.4 | 24.3 | 26.0 | M vs. L | -- | 0.586 |
| | | 95% C.I. | (17.4,35.4) | (16.1,32.5) | (17.2,34.7) | H vs. L | -- | 0.917 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.618 |
| | | Adj. Mean | 25.7 | 26.4 | 28.1 | M vs. L | -- | 0.785 |
| | | 95% C.I. | (21.3,30.2) | (21.9,30.8) | (23.5,32.7) | H vs. L | -- | 0.340 |

TABLE 12-11. (continued)

Adjusted Exposure Index for Psychology Variables by Occupation

| Variable | Occupation | Statistic | Exposure Index | | | Exposure Index Contrast | Adj. Relative Risk (95% C.I.) | p-Value |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Medium | High | | | |
| MCMI Psychotic Delusion Score | Officer | n | 128 | 121 | 124 | Overall | | 0.853** |
| | | Adj. Mean** | 43.2 | 41.9 | 43.1 | M vs. L | -- | 0.614** |
| | | 95% C.I.** | (32.7,53.8) | (31.2,52.5) | (32.4,53.8) | H vs. L | -- | 0.969** |
| | Enlisted Flyer | n | 52 | 62 | 50 | Overall | | 0.972 |
| | | Adj. Mean | 31.2 | 32.0 | 32.1 | M vs. L | -- | 0.842 |
| | | 95% C.I. | (17.1,45.3) | (19.3,44.7) | (18.5,45.7) | H vs. L | -- | 0.832 |
| | Enlisted Groundcrew | n | 140 | 155 | 133 | Overall | | 0.100 |
| | | Adj. Mean | 50.1 | 54.2 | 54.6 | M vs. L | -- | 0.075 |
| | | 95% C.I. | (43.4,56.9) | (47.1,61.3) | (47.8,61.5) | H vs. L | -- | 0.054 |

****Exposure index-by-covariate interaction ($p \leq 0.01$)--adjusted relative risk/mean, confidence interval, and p-value not presented.

**Exposure index-by-covariate interaction ($0.01 < p \leq 0.05$)--adjusted relative risk/mean, confidence interval, and p-value derived from a model fitted after deletion of this interaction.

--Relative risk/confidence interval/p-value not given due to cells with zero frequency; estimated relative risk not applicable for continuous analysis of a variable.

[a]Transformed from natural logarithm scale.

[b]Transformed from natural logarithm (X+1) scale.

[c]Transformed from square root scale.

[d]Transformed from square scale.

TABLE 12-12.

Summary of Exposure Index-by-Covariate
Interactions From Adjusted Analyses for Psychology Variables*

| Variable | Occupation | Covariate | p-Value |
|---|---|---|---|
| Involuntarily Falling Asleep During the Day | Officer | Age | 0.008 |
| | | Education | 0.006 |
| | | Lifetime Alcohol History | 0.022 |
| Involuntarily Falling Asleep During the Day | Enlisted Groundcrew | Education | 0.011 |
| Great or Disabling Fatigue During the Day | Officer | Age | 0.010 |
| | | Lifetime Alcohol History | 0.022 |
| Great or Disabling Fatigue During the Day | Enlisted Flyer | Lifetime Alcohol History | 0.034 |
| | | Race | 0.021 |
| Frightening Dreams | Officer | Age | 0.001 |
| | | Education | 0.020 |
| | | Lifetime Alcohol History | 0.040 |
| Frightening Dreams | Enlisted Groundcrew | Age | 0.024 |
| | | Race | 0.015 |
| | | Education | 0.003 |
| | | Current Alcohol Use | 0.017 |
| Talking in Sleep | Officer | Current Alcohol Use | 0.025 |
| Talking in Sleep | Enlisted Flyer | Age | 0.023 |
| | | Current Alcohol Use | 0.031 |
| Sleepwalking | Officer | Lifetime Alcohol History | 0.020 |
| Abnormal Movement/Activity During the Night | Officer | Current Alcohol Use | 0.015 |
| Snore Loudly in All Sleeping Positions | Enlisted Groundcrew | Age | 0.024 |
| Insomnia | Enlisted Flyer | Education | 0.035 |
| Overall Sleep Disorder Index | Officer | Lifetime Alcohol History | 0.022 |
| Overall Sleep Disorder Index | Enlisted Flyer | Education | 0.005 |
| Average Sleep Each Night | Officer | Current Alcohol Use | 0.025 |
| Average Sleep Each Night | Enlisted Flyer | Age | 0.001 |
| Average Sleep Each Night | Enlisted Groundcrew | Age | 0.033 |

TABLE 12-12. (continued)

Summary of Exposure Index-by-Covariate
Interactions From Adjusted Analysis for Psychology Variables*

| Variable | Occupation | Covariate | p-Value |
|---|---|---|---|
| SCL-90-R Depression | Enlisted Flyer | Age | 0.042 |
| SCL-90-R Obsessive-Compulsive Behavior | Enlisted Flyer | Age<br>Education<br>Current Alcohol Use | <0.001<br>0.035<br>0.011 |
| SCL-90-R Phobic Anxiety | Enlisted Flyer | Education<br>Current Alcohol Use | <0.001<br><0.001 |
| SCL-90-R Psychoticism | Enlisted Flyer | Age<br>Lifetime Alcohol History<br>Current Alcohol Use | 0.002<br>0.002<br>0.050 |
| SCL-90-R GSI | Officer | Age | 0.006 |
| SCL-90-R PSDI | Enlisted Groundcrew | Age | 0.020 |
| SCL-90-R PST | Officer | Age | 0.021 |
| SCL-90-R PST | Enlisted Flyer | Age<br>Education | 0.020<br>0.015 |
| MCMI Schizoid Score | Enlisted Groundcrew | Race | 0.021 |
| MCMI Dependent Score | Officer | Age | 0.044 |
| MCMI Histrionic Score | Officer | Lifetime Alcohol History | 0.014 |
| MCMI Histrionic Score | Enlisted Groundcrew | Race | 0.001 |
| MCMI Narcissistic Score | Enlisted Groundcrew | Race | 0.008 |
| MCMI Borderline Score | Officer | Lifetime Alcohol History | 0.002 |
| MCMI Borderline Score | Enlisted Groundcrew | Education | 0.007 |
| MCMI Paranoid Score | Enlisted Flyer | Age | 0.042 |
| MCMI Somatoform Score | Enlisted Groundcrew | Education | 0.032 |
| MCMI Alcohol Abuse Score | Officer | Lifetime Alcohol History<br>Current Alcohol Use | 0.004<br>0.002 |
| MCMI Drug Abuse Score | Enlisted Groundcrew | Race | 0.001 |
| MCMI Psychotic Thinking Score | Enlisted Flyer | Age | 0.034 |

TABLE 12-12. (continued)

Summary of Exposure Index-by-Covariate
Interactions From Adjusted Analysis for Psychology Variables*

| Variable | Occupation | Covariate | p-Value |
|---|---|---|---|
| MCMI Psychotic Thinking Score | Enlisted Groundcrew | Age | 0.015 |
| MCMI Psychotic Delusion Score | Officer | Lifetime Alcohol History | 0.048 |
| | | Current Alcohol Use | 0.018 |

*Refer to Table I-3 for a further investigation of these interactions.

For the officer cohort, the overall test revealed a borderline signifi-
cant difference based on the unadjusted and adjusted analyses (p=0.084 and
p=0.058, respectively). The percentages of officers who reported having
trouble falling asleep were 5.4, 5.7, and 12.0 for the low, medium, and high
exposure categories, respectively. For both analyses, the high versus low
contrasts were borderline significant (p=0.096, unadjusted and p=0.062,
adjusted). In the unadjusted analysis of the high versus low contrast, the
estimated relative risk was 2.40 (95% C.I.: [0.94,6.09]). Based on the
adjusted analysis of this contrast, the adjusted relative risk was 2.52 (95%
C.I.: [0.95,6.65]).

## Waking Up During the Night

For the enlisted flyer cohort, no significant difference for waking up
during the night was detected in either the unadjusted or adjusted analysis.
The overall tests for the officer cohort also did not reveal any significant
differences; however, the high versus low contrast in the unadjusted analysis
showed a borderline significant difference (Est. RR: 2.10, 95% C.I.:
[0.99,4.45], p=0.074). The percentages of officers who reported that they
wake up during the night were 9.2, 11.4, and 17.6 for the low, medium, and
high exposure categories, respectively.

In the unadjusted analysis of the enlisted groundcrew, a significant
difference was detected in the overall test (p=0.003). The percentages of
enlisted groundcrew who reported this sleep disorder were 16.6, 17.3, and 5.1
for the low, medium, and high exposure categories, respectively. The high
versus low contrast revealed a significant difference (Est. RR: 0.27, 95%
C.I.: [0.11,0.65], p=0.003). The adjusted analyses revealed similar results.
Significant differences were detected in the overall test (p=0.002) and the
high versus low contrast (Adj. RR: 0.26, 95% C.I.: [0.11,0.64], p=0.003).
The results for the analyses of the enlisted groundcrew cohort did not support
an increasing dose-response relationship.

## Waking Up Too Early and Can't Go Back to Sleep

No significant differences were detected in the unadjusted or adjusted
exposure analyses of waking too early in any of the occupational cohorts.

## Waking Up Unrefreshed

The unadjusted exposure index analyses of waking up unrefreshed did not
reveal any significant differences. This finding was supported by the
adjusted analyses for the officer and enlisted groundcrew cohorts. For the
unadjusted analysis of the enlisted flyer cohort, the percentages of Ranch
Hands who reported that they wake up unrefreshed were 5.6, 7.9, and 13.5 for
the low, medium, and high exposure categories, respectively. In the adjusted
analysis, the high versus low contrast detected a marginally significant
difference (Adj. RR: 5.66, 95% C.I.: [0.84,38.32], p=0.076).

## Involuntarily Falling Asleep During the Day

Based on the unadjusted analyses for the enlisted flyer and enlisted groundcrew cohorts, no significant differences in involuntary daytime sleep were identified. For the unadjusted analysis of the officer cohort, the overall test revealed a marginally significant difference among exposure categories (2.3% for low, 5.7% for medium, and 0.8% for high; p=0.064); however, the results of the medium versus low and high versus low contrasts were not significant.

The adjusted results supported the unadjusted findings for the enlisted flyer cohort. For the officer cohort, there were three significant inter-actions with the exposure index: age (p=0.008), education (p=0.006), and lifetime alcohol history (p=0.022). After stratifying by these covariates, there were many sparse cells. For the Ranch Hand officers who were born between 1923 and 1941, have a high school education, and were classified as moderate drinkers based on their lifetime alcohol history, a borderline significant difference was detected in the overall test (28.6% for low, 40.0% for medium, and 0.0% for high; p=0.095). The medium versus low and high versus low contrasts for this stratum were not significant.

There was a significant exposure index-by-education interaction found in the adjusted analysis of the enlisted groundcrew cohort (p=0.011). After stratifying by education, a significant difference was found for the high school-educated enlisted groundcrew (7.8% for low, 1.7% for medium, and 2.0% for high; p=0.032). For this stratum, the medium versus low contrast was marginally significant (p=0.065) but not suggestive of a dose-response effect. Without the significant interaction in the model, no significant differences were detected.

## Great or Disabling Fatigue During the Day

The unadjusted exposure index analyses did not detect any significant differences for the officer and enlisted flyer cohorts in the presence of daytime fatigue. For the enlisted groundcrew cohort, the high versus low exposure contrast was borderline significant, although the result did not support an increasing dose-response relationship (8.3% for low, 5.8% for medium, and 2.9% for high; p=0.088). This contrast was significant in the adjusted analysis (p=0.050).

In the adjusted analysis of the officer cohort, the age and lifetime alcohol history interactions with the exposure index were significant (p=0.010 and p=0.022, respectively). After stratifying by the covariates, a borderline significant difference was identified for the moderate drinkers born between 1923 and 1941 where there was a total of three abnormalities, which were all in the high exposure category (p=0.079). For the enlisted flyer cohort, there were significant interactions involving the exposure index for race and lifetime alcohol history (p=0.021 and p=0.034, respectively). No significant differences were detected within the enlisted flyer cohort after stratifying by the covariates or without the significant interactions in the model.

## Frightening Dreams

No significant differences in the occurrence of frightening dreams were detected in the unadjusted analyses. These findings were supported by the adjusted analyses; however, there were significant interactions involving the exposure index in the analyses of the officer and enlisted groundcrew cohorts. After stratifying by the covariates, there were many sparse cells. No significant differences were revealed. The significant interactions involving the exposure index for the officer cohort were age ($p=0.001$), education ($p=0.020$), and lifetime alcohol history ($p=0.040$). For the enlisted groundcrew cohort, the age ($p=0.024$), race ($p=0.015$), education ($p=0.003$), and current alcohol use ($p=0.017$) interactions with the exposure index were significant.

## Talking in Sleep

There was no evidence of a significant dose-response relationship for talking during sleep based on the unadjusted analyses. The adjusted analyses of the enlisted groundcrew cohort also did not detect any significant differences. For the officer cohort, there was a significant exposure index-by-current alcohol use interaction ($p=0.025$). However, after stratifying by current alcohol use, no significant differences were detected. The analyses without the significant exposure index-by-current alcohol use interaction in the model also did not reveal any significant differences.

For the enlisted flyer cohort, the age and current alcohol use interactions with the exposure index were significant ($p=0.023$ and $p=0.031$, respectively). Stratifying by these covariates, two enlisted flyers in the low exposure category who were born in or after 1942 and classified as light drinkers based on current alcohol use reported talking in their sleep. In comparison, no enlisted flyers with these characteristics in the medium and high exposure categories reported that they talk in their sleep. The result of the overall test was marginally significant (20.0% for low, 0.0% for medium, and 0.0% for high; $p=0.064$), but the individual contrasts were not significant. No significant differences were found without the significant interactions in the model.

## Sleepwalking

The results of the unadjusted analyses of sleepwalking did not reveal any significant differences. These findings were supported by the adjusted analyses for the enlisted flyer and enlisted groundcrew cohorts. For the officer cohort, the exposure index-by-lifetime alcohol history interaction was significant ($p=0.020$). No significant differences were found in the officer cohort after stratifying by lifetime alcohol history or without the interaction in the model.

## Abnormal Movement/Activity During the Night

No significant differences in abnormal movement/activity during the night were detected in the unadjusted and adjusted analyses for the enlisted flyer

and enlisted groundcrew cohorts. In the unadjusted analysis of the officer cohort, no significant difference was identified, and in the adjusted analysis there was a significant exposure index-by-current alcohol use interaction (p=0.015). Exploration of the interaction found no significant differences. There were also no significant differences detected in the analysis without the interaction in the model.

### Sleep Problems Requiring Medication

Based on the unadjusted and adjusted analyses, no significant differences in sleeping problems requiring medication were detected in any of the occupational cohorts.

### Snore Loudly in All Sleeping Positions

The unadjusted analyses of snoring did not reveal any significant differences in any occupational cohort. This was also true for the adjusted analysis of the enlisted flyer cohort. In the officer cohort, where the percentages of officers who reported that they snore loudly in all sleeping positions were 5.4, 4.9, and 10.4 for the low, medium, and high exposure categories, respectively, the result of the adjusted overall test was borderline significant (p=0.083). The high versus low contrast was also marginally significant (Adj. RR: 2.58, 95% C.I.: [0.84,7.93], p=0.097).

In the adjusted analysis of the enlisted groundcrew cohort, there was a significant exposure index-by-age interaction (p=0.024). After stratifying by age, a significant difference was found for the enlisted groundcrew born between 1923 and 1941 (p=0.024). The high versus low contrast was also significant (p=0.020). Of the enlisted groundcrew born between 1923 and 1941, 15.7 percent of those in the high exposure category reported having this sleep disorder, as compared to 1.8 percent on the low exposure category and 6.1 percent in the medium exposure category. The overall test for the enlisted groundcrew born in or after 1942 was borderline significant (6.3% for low, 11.6% for medium, and 2.6% for high; p=0.061) although the individual contrasts were not significant. Without the exposure index-by-age interaction in the model, the medium versus low exposure contrast was borderline significant (5.5% for low, 10.3% for medium, and 8.0% for high; p=0.052).

### Insomnia

Based on the unadjusted exposure index analyses of insomnia, there were no significant differences detected. Similar results were found for the officer and enlisted groundcrew cohorts in the adjusted analyses. For the enlisted flyer cohort, there was a significant exposure index-by-education interaction (p=0.035). Stratifying by education showed that the overall test for the college-educated stratum was borderline significant (0.0% for low, 31.3% for medium, and 27.3% for high; p=0.087). The medium versus low exposure contrast was also borderline significant (p=0.074). Without the exposure index-by-education interaction in the model, no significant differences were detected.

## Overall Sleep Disorder Index

For the officer cohort, the percentages of abnormalities on the overall sleep disorder index were 26.2, 27.6, and 40.8 for the low, medium, and high exposure categories, respectively. In the unadjusted analysis, the overall test and the high versus low exposure contrast were significant (p=0.023 and p=0.019, respectively). The estimated relative risk for the high versus low exposure contrast was 1.95 (95% C.I.: [1.15,3.30]). In the adjusted analysis of the officer cohort, there was a significant exposure index-by-lifetime alcohol history interaction (p=0.022). Stratifying by this covariate revealed that the overall test for the officers classified as heavy drinkers was significant (38.1% for low, 23.1% for medium, and 61.3% for high; p=0.013). The high versus low exposure contrast for the officers classified as moderate drinkers based on lifetime alcohol history was marginally significant (22.7% for low, 27.2% for medium, and 36.3% for high; p=0.069). Without the interaction in the model, high versus low exposure contrast was significant (Adj. RR: 1.81, 95% C.I.: [1.02,3.20], p=0.043). The overall test for the officer cohort was borderline significant without the interaction term in the model (p=0.069).

For the enlisted flyer cohort, the results of the unadjusted analysis did not reveal any significant differences. However, in the adjusted analysis, there was a significant exposure index-by-education interaction (p=0.005). Further examination of the interaction showed that the overall test for the enlisted flyers with a college education was significant (p=0.016). For this stratum, the percentages of participants who were classified as abnormal were 0.0, 43.8, and 45.5 for the low, medium, and high exposure categories, respectively. The high versus low and medium versus low exposure contrasts within this stratum were also significant (p=0.022 and p=0.015, respectively).

In the analyses of the enlisted groundcrew cohort, no significant differences were detected.

## Average Sleep Each Night

The unadjusted exposure index analyses did not detect any significant differences in the average hours of sleep each night. These findings were supported by the adjusted analyses when significant interactions involving the exposure index were excluded from the model for the officer and enlisted groundcrew cohorts.

For the officer cohort, there was a significant exposure index-by-current alcohol use interaction (p=0.025). Stratifying by current alcohol use showed that the medium versus low exposure contrast for the officers who were classified as moderate drinkers was significant (adjusted means: 6.75 hours for low, 7.28 hours for medium, and 6.95 hours for high; p=0.033).

In the adjusted analysis of the enlisted flyer cohort, the exposure index-by-age interaction was significant (p=0.001); however, no individual contrasts were found to be significant.

The exposure index-by-age interaction was also significant in the adjusted analysis of the enlisted groundcrew cohort (p=0.033). Stratifying by

age identified no significant differences for the enlisted groundcrew born in or after 1942. For those born between 1923 and 1941, the adjusted means were 6.64 hours, 7.12 hours, and 6.60 hours for the low, medium, and high exposure categories, respectively. The contrast of the medium and low categories was borderline significant (p=0.051). The medium versus low exposure contrast was also marginally significant for the enlisted groundcrew born in or before 1922, where the adjusted means were 7.09 hours, 4.82 hours, and 6.69 hours for the low, medium, and high exposure categories, respectively (p=0.069).

## Physical Examination Variables: SCL-90-R

### Anxiety

No significant differences in anxiety from the SCL-90-R were detected for the officer and enlisted groundcrew cohorts. For the enlisted flyer cohort, the percentages of abnormalities were 0.0, 9.3, and 8.5 for the low, medium, and high exposure categories, respectively. In the unadjusted analysis, the overall test and the medium versus low exposure contrast were borderline significant (p=0.097 and p=0.072, respectively). In the adjusted analysis, the overall test was significant (p=0.022).

### Depression

The results of the unadjusted analyses of depression from the SCL-90-R did not reveal any significant differences. These findings were supported by the results of the adjusted analysis for the enlisted groundcrew cohort. For the officer cohort, the percentages of abnormalities were 1.8, 3.9, and 7.3 for the low, medium, and high exposure categories, respectively. The high versus low exposure contrast was borderline significant (Adj. RR: 4.72, 95% C.I.: [0.90,24.88], p=0.067). In the enlisted flyer cohort, there was a significant exposure index-by-age interaction (p=0.042). Further investigation of the interaction did not identify any significant differences.

### Hostility

No differences were detected for hostility in the analyses of the enlisted flyer and enlisted groundcrew cohorts. In the officer cohort, there were six abnormalities, which were all in the high exposure category. In the unadjusted analyses, the overall test and high versus low contrast were significant (p=0.003 and p=0.030, respectively). The overall test was also significant in the adjusted analysis (p=0.002).

### Interpersonal Sensitivity

Neither the unadjusted nor adjusted analyses of the interpersonal sensitivity from the SCL-90-R identified any significant differences in any occupation.

## Obsessive-Compulsive Behavior

Based on the unadjusted analyses, there were no significant differences in obsessive-compulsive behavior. The same results were found for the adjusted analyses of the officer and enlisted groundcrew cohorts. In the adjusted analysis of the enlisted flyer cohort, there were three significant interactions involving the exposure index: age (p<0.001), education (p=0.035), and current alcohol use (p=0.011). Sparse cells resulted from stratifying by these three covariates. Further analysis did not detect any significant differences.

## Paranoid Ideation

In the officer cohort, there were four abnormalities in paranoid ideation on the SCL-90-R. All of these were in the high exposure category (p=0.020 unadjusted and p=0.013 adjusted). For the enlisted flyer cohort, there was one abnormality in the low exposure category and three in the high exposure category. Although the unadjusted analysis of the enlisted flyer cohort did not detect any significant differences, the overall test was borderline significant based on the adjusted analysis (p=0.053). Among the enlisted groundcrew, the percentages of abnormalities were 9.2, 5.6, and 3.2 for the low, medium, and high exposure categories, respectively. The high versus low exposure contrast for the enlisted groundcrew in both the unadjusted and adjusted analyses was borderline significant (Est. RR: 0.33, 95% C.I.: [0.10,1.05], p=0.087 unadjusted; Adj. RR: 0.35, 95% C.I. [0.11,1.15], p=0.085 adjusted). The enlisted groundcrew results did not support an increasing dose-response relationship.

## Phobic Anxiety

No differences in phobic anxiety were detected in the officer cohort.

In the enlisted flyer cohort, 2.0 percent of the low, 13.0 percent of the medium, and 6.4 percent of the high exposure categories had abnormal scores. The overall test for the enlisted flyer category was borderline significant, based on the unadjusted analysis (p=0.100). The high versus low exposure contrast was also borderline significant (Est. RR: 7.15, 95% C.I.: [0.85,60.37], p=0.082). In the adjusted analysis, the interactions with education and current alcohol use involving the exposure index were significant (p<0.001 for both). Stratifying by the two covariates showed that the overall test for the light drinkers with a high school education was significant (3.0% for low, 16.1% for medium, and 0.0% for high; p=0.026).

For the enlisted groundcrew cohort, the percentages of abnormalities were 12.2, 8.4, and 6.5 for the low, medium, and high exposure categories, respectively. No significant differences were detected in the unadjusted analyses; however, in the adjusted analyses, the high versus low exposure contrast was borderline significant (Adj. RR: 0.44, 95% C.I.: [0.17,1.10], p=0.080).

## Psychoticism

In the officer cohort, the percentages of abnormalities on the psychoticism scale were 0.9, 1.9, and 9.1 for the low, medium, and high exposure categories, respectively. Based on the unadjusted analyses, the overall test was significant (p=0.004), and there was a significant difference detected in the high versus low exposure contrast (Est. RR: 10.80, 95% C.I.: [1.36,85.89], p=0.010). Based on the adjusted analysis, the overall test for the officer cohort was borderline significant (p=0.007), and the high versus low exposure contrast was significant (Adj. RR: 9.91, 95% C.I.: [1.17,84.22], p=0.036).

The unadjusted analysis of the enlisted flyer cohort did not reveal any significant differences. In the adjusted analysis, there were three significant interactions involving the exposure index: age (p=0.002), lifetime alcohol history (p=0.002), and current alcohol use (p=0.050). After stratification, there were many sparse cells. The only significant result found was for the overall test for enlisted flyers who were born between 1923 and 1941, classified as heavy drinkers based on lifetime alcohol history, and classified as light drinkers based on current alcohol use (p=0.042). For this stratum, there were two abnormalities, which were in the high exposure category.

For the enlisted groundcrew, there were no significant differences identified in the unadjusted analysis. These findings were supported by the adjusted results.

## Somatization

No significant differences were detected in the unadjusted or adjusted analyses of somatization from the SCL-90-R in any occupational cohort.

## GSI

The results of the unadjusted analyses revealed no significant differences in the GSI. These findings were supported by the adjusted results for the enlisted flyer and enlisted groundcrew cohorts. For the officer cohort, there was a significant exposure index-by-age interaction (p=0.006). After stratifying by age, there was one abnormality among those born in or before 1922, which was in the high exposure category; the overall test detected a significant difference (p=0.031).

## PSDI

No significant differences in the PSDI were found in the unadjusted and adjusted analyses of the officer and enlisted flyer cohorts. Although the unadjusted analysis of the enlisted groundcrew did not reveal any significant differences, there was a significant exposure index-by-age interaction (p=0.020). After stratifying by age, the overall test for those born between 1923 and 1941 revealed a borderline significant difference (10.0% for low, 0.0% for medium, and 14.3% for high; p=0.096). There were no significant differences without the interaction in the model.

<u>PST</u>

Based on the unadjusted analyses, there were no significant differences detected in the PST. A similar result was obtained in the adjusted analysis of the enlisted groundcrew cohort; this was also true for the officer and enlisted flyer cohorts when significant interactions involving the exposure index were excluded from the model. For the officer cohort, there was a significant exposure index-by-age interaction (p=0.021). Further investigation showed that there was only one abnormality among the officers who were born in or before 1922, which was in the high exposure category (p=0.031). In the enlisted flyer cohort, the exposure index-by-age and the exposure index-by-education interactions were significant (p=0.020 and p=0.015, respectively). However, no significant differences were found after stratifying by age and education.

Physical Examination Variables:  MCMI

### Schizoid Score

In the unadjusted analyses of the schizoid score, no significant differences were detected. A similar result was found for the officer cohort based on the adjusted analysis. In the enlisted flyer cohort, the adjusted mean scores were 19.2, 23.2, and 19.3 for the low, medium, and high exposure categories, respectively. In the adjusted analysis, the medium versus low exposure contrast was marginally significant (p=0.095). For the enlisted groundcrew, the exposure index-by-race interaction was significant (p=0.021). After stratifying by race, the medium versus low and high versus low exposure contrasts for the Black enlisted groundcrew were significant but not suggestive of a dose-response effect (adjusted means of 31.3 for low, 19.3 for medium, and 19.6 for high; p=0.025 and p=0.039, respectively). Without the significant interactions in the model, no significant differences were found.

### Avoidant Score

No significant differences were detected in the unadjusted or adjusted analyses of the avoidant score for the officer and enlisted groundcrew cohorts. The results of unadjusted analysis of the enlisted flyer cohort also did not identify any significant differences. For the enlisted flyer cohort, the mean avoidant scores based on the adjusted analysis were 10.1, 13.3, and 11.6 for the low, medium, and high exposure categories, respectively. The result of the medium versus low exposure contrast was borderline significant (p=0.095).

### Dependent Score

In the officer cohort, no differences in the dependent score were detected in the unadjusted analysis. In the adjusted analysis, there was a significant exposure index-by-age interaction (p=0.044). After stratifying by age, the medium versus low exposure contrasts for the officers who were born in or after 1942 and who were born in or before 1922 were significant (p=0.045

and p=0.032, respectively). For the officers born in or after 1942, the adjusted means were 44.5, 35.0, and 41.2 for the low, medium, and high exposure categories, respectively. The adjusted means were 62.0 for the low, 39.6 for the medium, and 69.5 for the high exposure categories among the officers who were born in or before 1922. Without the interaction in the model, there were no significant differences.

No significant differences were found in the exposure index analyses for the enlisted flyer and enlisted groundcrew cohorts.

### Histrionic Score

Based on the unadjusted analyses of the histrionic score, there were no significant differences among the exposure categories for the officer cohort. In the adjusted analysis, the exposure index-by-lifetime alcohol history interaction was significant (p=0.014). After stratifying by lifetime alcohol history, the adjusted mean scores for the nondrinking officers were 57.8, 37.1, and 63.6 for the low, medium, and high exposure categories, respectively. Based on the adjusted analysis, the medium versus low exposure contrast was borderline significant (p=0.080). Without the interaction in the model, there were no significant differences identified.

No significant differences were found in the analyses of the enlisted flyer cohort.

For the enlisted groundcrew cohort, the mean scores were 63.9, 60.6, and 61.4 for the low, medium, and high exposure categories, respectively. The medium versus low exposure contrast was borderline significant (p=0.055). The exposure index-by-race interaction was significant in the adjusted analysis of the enlisted groundcrew cohort (p=0.001). Stratifying by race revealed that all four contrasts were significant. For the Black enlisted groundcrew, the adjusted mean scores were 61.2, 74.7, and 73.6 for the low, medium, and high exposure categories, respectively (p=0.005 for medium versus low; p=0.015 for high versus low). The adjusted mean scores for the nonblack enlisted groundcrew were 63.5, 57.9, and 59.9 for the low, medium, and high exposure categories, respectively (p=0.002 for medium vs. low; p=0.046 for high vs. low).

### Narcissistic Score

No differences were found in the unadjusted and adjusted analyses for the narcissistic score in the officer and enlisted flyer cohorts. For the enlisted groundcrew cohort, no difference was identified in the unadjusted analysis. In the adjusted analysis, the exposure index-by-race interaction was significant (p=0.008). After stratifying by race, the adjusted mean scores for the Black enlisted groundcrew were 64.6, 72.2, and 82.4 for the low, medium, and high exposure categories, respectively. The high versus low contrast was significant (p=0.003).

### Antisocial Score

The results of the exposure index analyses of the MCMI antisocial score did not detect any significant differences among the exposure categories.

## Compulsive Score

None of the unadjusted or adjusted analyses of the MCMI compulsive score revealed a significant difference among the exposure categories.

## Passive-Aggressive Score

The unadjusted analyses did not identify any significant differences. The results of the adjusted analyses supported these findings except for the enlisted flyer cohort, where the medium versus low exposure contrast was marginally significant (p=0.067). The adjusted mean scores for the enlisted flyers were 11.9, 16.2, and 15.8 for the low, medium, and high exposure categories, respectively.

## Schizotypal Score

No significant differences were found among the exposure categories based on the analyses of the MCMI schizotypal score.

## Borderline Score

In the unadjusted analysis of the borderline score the officer cohort, the overall test and medium versus low contrasts were significant (p=0.045 and p=0.017, respectively). The mean scores for the officers were 29.8, 25.4, and 29.2 for the low, medium, and high exposure categories, respectively. In the adjusted analysis, the exposure index-by-lifetime alcohol history interaction was significant (p=0.002). After stratifying by the covariate, the results showed that the medium versus low and high versus low exposure contrasts were significant for the heavy drinkers (adjusted mean scores: 45.4, 30.6, and 36.5 for low, medium, and high, respectively; p=0.001 for medium vs. low and p=0.041 for high vs. low). The medium versus low exposure contrast for the moderate drinkers was marginally significant (adjusted mean scores: 34.3, 30.6, and 33.4 for low, medium, and high exposure categories, respectively; p=0.095).

No differences were detected in the analyses for the enlisted flyers.

In the unadjusted analysis of the enlisted groundcrew, no significant differences were found. In the adjusted analysis, there was a significant exposure index-by-education interaction (p=0.007). Stratifying by education revealed a significant difference between the medium and low exposure categories for the college-educated enlisted groundcrew (adjusted mean scores: 33.2, 45.1, and 36.1 for the low, medium, and high exposure categories; p=0.005).

## Paranoid Score

In the analyses of the paranoid score in the officer cohort, no significant differences were detected. This finding was also true for the unadjusted analysis of the enlisted flyer cohort and for the adjusted analysis without the significant exposure index-by-age interaction (p=0.042).

Stratifying by age showed that there was a significant difference between the high and low exposure categories for the enlisted flyers born in or after 1942, although the finding did not support an increasing dose-response relationship (adjusted mean scores: 59.6 for low, 52.3 for medium, and 44.2 for high; p=0.030 high vs. low). For the enlisted groundcrew, the mean scores were 53.4, 56.5, and 55.1 for low, medium, and high, respectively. The medium versus low contrasts were marginally significant for the unadjusted and adjusted analyses (p=0.078 and p=0.053, respectively).

### Anxiety Score

No differences were identified among the exposure levels in the analyses of the MCMI anxiety score for any of the three occupational cohorts.

### Somatoform Score

For the officer and enlisted flyer cohorts, no significant differences in the somatoform score were detected. Based on the unadjusted analysis of the enlisted groundcrew cohort, no difference among exposure levels were found. In the adjusted analysis, there was a significant exposure index-by-education interaction (p=0.032). After stratifying by education, a significant difference between the medium and low exposure categories among the college educated was revealed (p=0.030). The adjusted mean scores for the enlisted groundcrew with a college education were 52.4, 61.3, and 55.9 for the low, medium, and high exposure categories, respectively. Without the interaction in the model, no significant differences were found in the enlisted groundcrew cohort.

### Hypomania Score

The unadjusted and adjusted analyses did not reveal any significant differences in the hypomania score for any of the three occupational categories.

### Dysthymia Score

The results of the exposure index analyses of the MCMI dysthymia score did not identify any significant differences among the exposure levels.

### Alcohol Abuse Score

The unadjusted analyses of the MCMI alcohol abuse score did not detect any significant differences among the exposure categories. These findings were supported by the results of the adjusted analyses of the enlisted flyer and enlisted groundcrew cohorts.

In the adjusted analysis of the officer cohort, there were two significant interactions involving the exposure index: lifetime alcohol history and current alcohol use (p=0.004 and p=0.002, respectively).

Stratifying by the two alcohol covariates resulted in sparse cells. The results showed that the adjusted mean scores for the officers classified as heavy drinkers based on lifetime alcohol history and current alcohol use in the high and low exposure categories were significantly different (adjusted mean scores: 31.3 for low, n=4; n=0 for medium; and 69.0 for high, n=2; p=0.004).

### Drug Abuse Score

There were no significant differences found among the exposure categories for the officer and enlisted flyer cohorts based on the analyses of the MCMI drug abuse score.

For the enlisted groundcrew cohort, no significant differences were detected in the unadjusted analysis. In the adjusted analysis, there was a significant exposure index-by-race interaction (p=0.001). The adjusted mean scores for the Black enlisted groundcrew were 45.4, 60.9, and 72.3 for the low, medium, and high exposure categories, respectively. Both the medium versus low and high versus low exposure contrasts were significant for this stratum (p=0.038 and p=0.001, respectively).

### Psychotic Thinking Score

Based on the unadjusted analysis, no significant differences in the psychotic thinking score were detected. These findings were supported by the adjusted analyses for the officer cohort. In the enlisted flyer and enlisted groundcrew cohorts, the exposure index-by-age interactions were significant (p=0.034 and p=0.015, respectively). After stratifying by age, a significant difference was detected for the high versus low exposure contrast among the enlisted flyers born between 1923 and 1941 (adjusted mean scores: 24.5 for low, 30.0 for medium, and 33.8 for high; p=0.032). For the enlisted groundcrew cohort, the high versus low exposure contrast for those born between 1923 and 1941 was borderline significant (adjusted mean scores: 32.5 for low, 28.6 for medium, and 38.8 for high; p=0.097). No significant differences were found without the exposure index-by-age interaction in the model for either cohort.

### Psychotic Depression Score

The results of the exposure index analyses on the MCMI psychotic depression score did not reveal any significant differences for any occupational cohort.

### Psychotic Delusion Score

For the officer cohort, no significant differences in the psychotic delusion score were identified in the unadjusted analyses or the adjusted analyses without significant interactions involving the exposure index. The lifetime alcohol history and current alcohol use interactions with the exposure index were significant (p=0.048 and p=0.018, respectively). Sparse

cells resulted from stratifying by the two alcohol covariates. The adjusted mean scores for the officers who were classified as moderate drinkers for both the lifetime alcohol history and current alcohol use were 25.5, 45.6, and 48.3 for the low, medium, and high exposure categories, respectively. For this stratum, both the medium versus low and high versus low exposure contrasts were significant (p=0.019 and p=0.010, respectively). For the officers who were heavy drinkers based on lifetime alcohol history and light drinkers based on current alcohol use, the medium versus low exposure contrast was borderline significant (p=0.091). This result did not support an increasing dose-response relationship, given that the highest adjusted mean score was for the low exposure category. There were four officers in the low exposure category and two in the high exposure category in the heavy drinker stratum based on both lifetime and current alcohol use. The high versus low exposure contrast for this stratum was significant (75.5 vs. 40.8; p=0.048).

No differences were found for the enlisted flyer cohort.

The mean psychotic delusion scores for the enlisted groundcrew cohort were 44.1, 47.6, and 48.8 for the low, medium, and high exposure categories, respectively. The high versus low exposure contrast was significant based on the unadjusted analysis (p=0.041). In the adjusted analysis, the overall test, medium versus low exposure contrast, and high versus low exposure contrast were borderline significant (p=0.100, p=0.075, and p=0.054, respectively).


DISCUSSION

Prior to the Air Force Health Study (AFHS) 1982 Baseline study, little scientifically validated information existed regarding the relationship between dioxin exposure and disturbances of cognition and emotions in man. The Baseline and 1985 followup studies attempted to explore these possible relationships using well-established questionnaires, personality inventories, and neuropsychological assessment techniques. These instruments included the CMI, the MMPI, and the HRB.

Analysis of extensive data generated by the CMI, MMPI, and HRB revealed few statistically significant differences between those Air Force veterans who sustained some level of exposure to dioxin (Ranch Hands) and their unexposed Comparison group. More specifically, the two groups did not differ signifi-cantly on several tests of cognitive (brain) function. The exposed (Ranch Hand) group reported a moderately greater number of diffuse medical (somatic) complaints on the CMI. They also registered moderately higher (but not statistically significant) scores on the MMPI scales that are influenced most heavily by physical complaints such as generalized feelings of lassitude and malaise, energy loss, mental and physical slowing, etc. The herbicide-exposed groundcrew group only demonstrated significantly higher scores on the MMPI depression scale.

Factors contributing to the modest differences between groups were not clearly indicated by estimated dioxin exposure data. It is possible that observed differences in psychological dependent variables might be related to some combination of negative expectations, anxiety, and amplified somatic sensitivity on the part of the exposed personnel. As the 1985 followup

concluded, the possibility existed that subjectively experienced and reported symptoms were more accurate than available exposure data.

A limited number of previous dioxin exposure studies reported similar findings to those described above. Investigations of both military and civilian groups failed to reveal evidence for organic brain dysfunction.[23,37] However, evidence of significantly elevated levels of tension/anxiety and anger/hostility were reported for at least one civilian group.[37] Psychological tests employed by some of these previous studies were limited when viewed in relation to the range of psychological assessment included in the prior Air Force studies. Nevertheless, the existence of independent corroborating data combined with previous AFHS findings indicated the importance of continuing some form of appropriate psychological assessment for the 1987 followup.

At the conclusion of the 1985 followup, a significant number of participants registered complaints regarding the lengthy and repetitious nature of the psychometric evaluation. Subsequent concern regarding potential loss of subjects for the 1987 followup led to specific changes in the psychometric component of the study. Previously unrevealing tests of cognition (HRB) were suspended, thereby reducing testing time by several hours. The issue of test-retest boredom was addressed by selecting two new psychometric instruments that would provide ongoing assessment of important psychological variables, while requiring one-half the administration time of the MMPI.

The SCL-90-R is a 90-item checklist of physical and mental symptoms that provides a reasonable measure of health-related concerns and associated anxiety, depression, and general emotional discomfort. The second test selected for the 1987 reevaluation was the MCMI. The MCMI provided backup measures of depression, anxiety, somatization, and hypochondriasis for the SCL-90-R, while also screening for personality disorders and major psychiatric syndromes including psychosis. Both the SCL-90-R and the MCMI have been extensively used in clinical and research settings requiring economical assessment of psychiatric disorder, physical disability status and response to specific therapies. Some methodological difficulties occurred when comparing data generated by these two tests to scores previously obtained using the MMPI. However, factor analysis and correlational studies indicated that specific scales and factors included in the new tests correlated reasonably well with comparable elements of the MMPI.[47-53] Therefore, acceptable continuity of psychological dependent variables was assured.

Addition of data concerning sleep disorders, as well as the 29 scales and 3 indices comprising the SCL-90-R and the MCMI, produced a relatively substantial increase in the number of psychological dependent variables requiring analysis for the 1987 followup. Similarly, the number of dependent variable-covariate associations requiring examination increased, as did the probability of observing a proliferation of statistically significant interactions.

Examination of the psychological dependent variable-by-covariate associations reported to date indicates a host of statistically significant relationships. For example, previously well-known relationships between advancing age and disturbed sleep were noted, as was the well-known phenomenon of sleep disturbance following excessive consumption of alcohol. An additional predictable outcome involved a strong relationship between the presence

of PTSD and a disturbance of virtually all sleep and psychological variables. Although the number of participants with PTSD was relatively small (approximately 1% of each group), the effects of this condition were quite striking and make this an important finding. A more definitive method for the diagnosis of PTSD is the structured psychiatric interview, a technique considered to be too logistically difficult in the context of this study. Therefore, the assessment of PTSD using a subscale of the MMPI was used. While the MMPI subscale may be less precise than the psychiatric interview, it was significantly associated with expected psychological endpoints in the covariate adjusted analyses, and it appears to be a useful technique in the assessment of PTSD in population-based studies.

On the other hand, some significant but puzzling and questionably valid or useful relationships were also demonstrated. For example, White subjects reported sleep disturbances more frequently than their Black counterparts. In addition, the study revealed a powerful relationship between education level and the number of sleep disorders registered. While 38.3 percent of high school-educated subjects reported sleep disturbances, only 30.4 percent of those with college-level education complained of disordered sleep. The 30.4 percent figure compares reasonably well with the 33.0 percent figure cited by sleep researchers as the number of adult Americans likely to report some sleep disturbances in any given year.[54] The apparent fact that study subjects with 12 or fewer years of education experience more sleep disturbance might be caused by greater levels of dissatisfaction with employment, financial pressures, participation in higher rates of shift work, and less regular exercise.

Further inspection of the 1987 data revealed a general persistence of several psychological results that were described as noteworthy in the Baseline and 1985 followup studies. On the SCL-90-R, the Ranch Hand group demonstrated statistically greater levels of depression than Comparison group members. They also manifested more physical complaints (somatization) and health-related anxieties than their Comparison group counterparts. The Ranch Hands also recorded higher scores on those MCMI scales thought to reflect antisocial and passive-aggressive traits and psychotic delusional tendencies. These latter psychological variables might be described as "new" in that they were not reported in the earlier studies. However, the appearance of these maladaptive traits and symptoms probably represents the emergence of artifacts related more to differences in the psychometric properties of the tests used than in the appearance of some new symptom complex.

Continuing manifestations of depression, somatic complaints, and health-related anxiety by members of the Ranch Hand cohort are not surprising. A similar persistence of entrenched symptom complexes has been demonstrated by other populations who have received exposure to known or suspected toxins.[55-58] Such individuals frequently demonstrate a pattern of self-perpetuating psychological and somatic symptoms that individual group members tend to experience in varying degrees. Air Force groundcrew members who report high levels of herbicide exposure may be particularly vulnerable to repeated suggestions that they have suffered negative psychological and physical consequences secondary to their exposure. Individuals with psychological makeups predisposing them to higher levels of anxiety, psychophysiological disturbances, and somatic concern tend to react rather dramatically to their situation. This type of response can operate to perpetuate a static and/or escalating number of physical and psychological symptoms.

Research has been conducted on the psycho-maintenance* of chronic physical illness that clearly indicated that a significant percentage (5-10%) of any medical population possess a psychological makeup that predisposes them to the development of symptom-reactive anxiety and psychophysiological disturbances that tend to develop in an escalating manner.[60,61] As a result, individuals of this type included in the current study may have obtained relatively high scores on those SCL-90-R and MCMI measures that are sensitive to the presence of anxiety, depression, and psychophysiological disturbances. Further, individuals who perceive themselves as injured may tend to harbor significant feelings of resentment and hostility that may contribute significantly to the previously noted high scores on antisocial, passive-aggressive, and psychotic delusion scales. In addition, a significantly higher level of alcohol consumption that may represent a form of self-medication may have also contributed to the significantly higher scale scores of the herbicide-exposed group members.

While factors other than dioxin exposure may have contributed to Ranch Hand test score abnormalities, previous studies in clinical medicine also suggest that caution may be appropriate. Studies have followed medical patients who were originally diagnosed as suffering from hysteria, hypochondriasis, or other psychiatric disorders. In some of these studies, more than 60 percent of the patients given psychiatric diagnoses eventually demonstrated neurological diseases, endocrine dysfunction, and other medical disorders.[62-65] It is therefore important to monitor the health of the study participants over the ensuing years.

## SUMMARY

The 1987 psychological assessment was based on verified psychological disorders; reported sleep disorders; and two psychological instruments, the SCL-90-R and the MCMI. The results of the psychological assessment are summarized in Table 12-13.

Five psychological disorders, which were self-reported and verified by medical record review, were analyzed in the psychological assessment: psychoses, alcohol dependence, drug dependence, anxiety, and other neuroses. No significant differences between the Ranch Hands and the Comparisons were detected based on the unadjusted analyses of psychoses, drug dependence, and anxiety. A marginally significant difference between the two groups was found for alcohol dependence and other neuroses (p=0.068 and p=0.056, respectively), with a greater percentage of Ranch Hands than Comparisons having these conditions.

The sleep disorder segment of the psychological assessment consisted of self-reported responses on 12 individual sleep disorders, 2 composite sleep disorder variables (based on the individual sleep disorders), and average hours of sleep each night. The results of the analyses without adjustments

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*Psycho-maintenance refers to psychological and behavioral perpetuation and/or exacerbation of physical illness.[59]

**TABLE 12-13.**

**Overall Summary Results of Unadjusted and Adjusted
Group Contrast Analyses of Psychology Variables**

| Variable | Type of Analysis | Unadjusted | Adjusted | Direction of Results |
|---|---|---|---|---|
| **Psychological Disorders** | | | | |
| Psychoses | D | NS | -- | |
| Alcohol Dependence | D | NS* | -- | RH>C |
| Drug Dependence | D | NS | -- | |
| Anxiety | D | NS | -- | |
| Other Neuroses | D | NS* | -- | RH>C |
| **Sleep Disorders** | | | | |
| Trouble Falling Asleep | D | NS | NS | |
| Waking up During the Night | D | NS | **** | |
| Waking up Too Early and Can't Go Back to Sleep | D | NS | ** (NS) | |
| Waking Up Unrefreshed | D | NS | NS | |
| Involuntarily Falling Asleep During the Day | D | NS | NS | |
| Great or Disabling Fatigue During the Day | D | 0.026 | NS* | RH>C |
| Frightening Dreams | D | NS | NS | |
| Talking in Sleep | D | 0.041 | **** | RH>C |
| Sleepwalking | D | NS | NS | |
| Abnormal Movement/Activity During the Night | D | NS | ** (NS) | |
| Sleep Problems Requiring Medication | D | NS | NS | |
| Snore Loudly in All Sleeping Positions | D | NS | NS | |
| Insomnia | D | NS | ** (NS) | |
| Overall Sleep Disorder Index | D | NS | ** (NS) | |
| Average Sleep Each Night | C | NS | NS | |
| **SCL-90-R** | | | | |
| Anxiety | D | NS | NS | |
| Depression | D | NS* | NS | RH>C |
| Hostility | D | NS | **** | |
| Interpersonal Sensitivity | D | NS | NS | |
| Obsessive-Compulsive Behavior | D | NS | NS | |
| Paranoid Ideation | D | NS | NS | |
| Phobic Anxiety | D | NS | NS | |

TABLE 12-13. (continued)

Overall Summary Results of Unadjusted and Adjusted
Group Contrast Analyses of Psychology Variables

| Variable | Type of Analysis | Unadjusted | Adjusted | Direction of Results |
|---|---|---|---|---|
| SCL-90-R (continued) | | | | |
| Psychoticism | D | NS | NS | |
| Somatization | D | NS* | ** (NS) | RH>C |
| GSI | D | NS* | NS | RH>C |
| PSDI | D | NS | ** (NS) | |
| PST | D | NS | NS | |
| MCMI | | | | |
| Schizoid Score | C | NS | NS | |
| Avoidant Score | C | NS | **** | |
| Dependent Score | C | 0.048 | ** (0.020) | C>RH |
| Histrionic Score | C | NS | ** (NS) | |
| Narcissistic Score | C | NS* | 0.015 | RH>C |
| Antisocial Score | C | <0.001 | 0.001 | RH>C |
| Compulsive Score | C | NS | ** (NS) | |
| Passive-Aggressive Score | C | NS | ** (NS) | |
| Schizotypal Score | C | NS | ** (NS) | |
| Borderline Score | C | NS | ** (0.050) | C>RH |
| Paranoid Score | C | 0.011 | 0.014 | RH>C |
| Anxiety Score | C | NS | **** | |
| Somatoform Score | C | NS | NS | |
| Hypomania Score | C | NS | NS | |
| Dysthymia Score | C | NS | NS | |
| Alcohol Abuse Score | C | NS | ** (NS) | |
| Drug Abuse Score | C | NS | NS | |
| Psychotic Thinking Score | C | NS | NS | |
| Psychotic Depression Score | C | NS | **** | |
| Psychotic Delusion Score | C | NS* | NS* | RH>C |

D: Discrete analysis performed.
NS: Not significant (p>0.10).
--: Analysis not done.
NS*: Borderline significant (0.05<p≤0.10).
RH>C: Higher prevalence rate or mean in Ranch Hands than in Comparisons.
****: Group-by-covariate interaction (p≤0.01); refer to Table I-2 for a
      detailed description of this interaction.
** (NS): Group-by-covariate interaction (0.01<p≤0.05); not significant
        when interaction is deleted; refer to Table I-2 for a detailed
        description of this interaction.
C: Continuous analysis performed.
** (0.020) and ** (0.050): Group-by-covariate interaction (0.01<p≤0.05);
                          significant when interaction is deleted (p-value
                          given).
C>RH: Higher mean in Comparisons than in Ranch Hands.

for covariates indicated that significantly more Ranch Hands than Comparisons reported that they experience great or disabling fatigue during the day and that they talk in their sleep (p=0.026 and p=0.041, respectively). The adjusted analysis of great or disabling fatigue during the day was marginally significant (p=0.065). In the adjusted analysis of talking in sleep, there was a significant group-by-PTSD interaction. Further analysis identified that of the participants without PTSD, marginally more Ranch Hands than Comparisons reported that they talk in their sleep (p=0.089).

The unadjusted analyses of the other 13 sleep disorder variables did not reveal any significant differences: trouble falling asleep, waking up during the night, waking up too early and can't go back to sleep, waking up unrefreshed, involuntarily falling asleep during the day, frightening dreams, sleepwalking, abnormal movement or activity during the night, sleep problems requiring medication, snoring loudly in all positions, insomnia, overall sleep disorder index, and average sleep each night. In general, this finding was supported by the results of the adjusted analyses, although significant group-by-covariate interactions were present in 5 of the 13 analyses. Further exploration of the interactions revealed no significant group differences in any stratum for three of the five variables. Of the participants born in or before 1922, significantly more Comparisons than Ranch Hands were classified as having insomnia (p=0.012). Marginally more Comparisons than Ranch Hands who were born in or before 1922 reported that they wake up during the night (p=0.078).

The SCL-90-R, a multidimensional self-reported symptom inventory designed to measure symptomatic psychological distress, yields nine primary symptom dimensions and three global indices of distress. No differences between the two groups were found for 7 of the 12 SCL-90-R scores: anxiety, interpersonal sensitivity, obsessive-compulsive behavior, paranoid ideation, phobic anxiety, psychoticism, and positive symptom total. Marginally significant differences between the two groups were detected for depression (p=0.090), somatization (p=0.073), and GSI (an index of symptom severity) (p=0.081), with a higher percentage of abnormalities in the Ranch Hands than in the Comparisons, based on the unadjusted analyses. For depression and the GSI, no differences were revealed after adjustment for covariates. In the adjusted analysis of somatization, there was a significant group-by-education interaction present in the model. Further investigation of the interaction showed that the high school-educated Ranch Hands had a significantly higher percentage of abnormalities on somatization than the Comparisons with a high school education (p=0.025).

Although no difference between the two groups was revealed in the unadjusted analysis of the SCL-90-R PSDI (an index of symptom intensity), there was a significant group-by-race interaction in the adjusted analysis. Exploration of the interaction revealed that the Black Comparisons had a marginally higher percentage of abnormalities than the Black Ranch Hands on this index (p=0.079). The unadjusted analysis of hostility from the SCL-90-R did not identify a significant difference between the two groups, and there was a significant group-by-PTSD interaction in the adjusted analysis. Stratifying by the presence or absence of PTSD did not reveal any significant differences between the Ranch Hands and the Comparisons in either stratum.

The MCMI, a self-administered test that measures eight basic personality patterns, three pathological personality disorders, and nine clinical symptom syndromes. The results of the unadjusted analyses of the MCMI scores showed no significant group differences for 15 of the 20 scores: schizoid, avoidant, histrionic, compulsive, passive-aggressive, schizotypal, borderline, anxiety, somatoform, hypomania, dysthymia, alcohol abuse, drug abuse, psychotic thinking, and psychotic depression. In the adjusted analyses of these variables, there were significant group-by-covariate interactions for 9 of the 15 analyses, which made the direct contrast of the two groups more difficult. Stratifying by the covariates in order to contrast the two groups within each stratum did not reveal a consistent pattern of significant detriment to either group. Significant differences were noted in 10 strata, and there were marginally significant differences detected in 6 strata. The mean score of the Ranch Hands exceeded that of the Comparisons for five of the significant strata and four of the marginally significant strata. However, many of these were strata where few participants were present (e.g., Blacks, participants with PTSD). Consequently, corresponding unadjusted results and models without the significant group-by-covariate interaction are primarily nonsignificant. For all except one variable where the analysis was repeated without the group-by-covariate interaction(s), no significant differences were revealed. In the analysis of the borderline score without the significant interaction involving group, the results showed that the Comparisons had a significantly higher mean score than the Ranch Hands (p=0.050).

The Ranch Hands were found to have significantly higher mean antisocial and paranoid scores than the Comparisons (antisocial: p<0.001 for unadjusted and p=0.001 for adjusted; paranoid: p=0.011 for unadjusted and p=0.014 for adjusted). On the psychotic delusion score, the mean score for the Ranch Hands was marginally higher than the Comparison mean score (p=0.061 for unadjusted and p=0.062 for adjusted). The results of the unadjusted analysis of the narcissistic score showed that the mean score for the Ranch Hands was marginally significantly higher than the mean score for the Comparisons (p=0.090); after adjusting for covariates, a significant difference was detected (p=0.015). Based on the unadjusted analysis, the Comparisons had a significantly higher mean dependent score than the Ranch Hands (p=0.048). In the adjusted analysis, there was a significant group-by-race interaction. Stratifying by race revealed that the nonblack Comparisons had a significantly higher mean score than the nonblack Ranch Hands (p=0.005) and the Black Ranch Hands had a marginally higher mean score than the Black Comparisons (p=0.086). Without the group-by-race interaction in the model, the Comparisons had a significantly higher mean score than the Ranch Hands (p=0.020).

The results of the exposure index analyses did not reveal a consistent pattern of an increasing dose-response relationship for any occupational cohort across the variables. The majority of the unadjusted analyses did not detect any significant differences among the exposure categories for the different occupational cohorts. Interactions involving the exposure index were frequently found in the adjusted analyses; however, exploration of the interactions did not identify a subgroup within the Ranch Hands that consistently demonstrated an increasing dose-response relationship. The occasional observation of significant and borderline findings in the officer cohort is difficult to interpret in view of the evolving understanding of the relatively low level of dioxin exposure experienced by officers.

In summary, significant or marginally significant differences between the Ranch Hands and the Comparisons were found for some variables within each of the four psychological assessment instruments of verified psychological disorders, reported sleep disorders, and the self-administered SCL-90-R and MCMI psychological examinations. However, there was a lack of consistency across similar variables included on the SCL-90-R, MCMI, and reported information. For these differences the Ranch Hands generally manifested a higher percentage of abnormalities or a higher mean score than the Comparisons. However, this is not surprising in light of the fact that individuals who perceive themselves as having been harmed might be more likely to report the symptoms observed as significant in this analysis. Profound effects of PTSD were noted for most all psychological variables. These results should be reexamined carefully for positive correlations between the complaints and increased levels of dioxin exposure when data from the serum dioxin assay become available. Additionally, significant group-by-covariate interactions were observed frequently in the adjusted analysis, which often made direct contrast of the two groups with adjustment for significant covariates difficult.

# CHAPTER 12

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