**Red light: A novel, non-pharmacological intervention to promote alertness in shift workers**

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*Supplementary Table 1. The number of participants included in the statistical analysis, excluding outliers, by outcome measure and shift type.*

| Outcome/ Shift type | Light color | Time | Participants included in analyses (n) | |
|---|---|---|---|---|
| | | | Day shift | Night shift |
| *Visual performance testing outcomes* | | | | |
| *Psychomotor vigilance test (PVT) task* | Red | T1 | 19 | 9 |
| | | T2 | 21 | 9 |
| | | T3 | 19 | 12 |
| | Blue | T1 | 16 | 13 |
| | | T2 | 16 | 13 |
| | | T3 | 17 | 13 |
| | White | T1 | 15 | 18 |
| | | T2 | 14 | 18 |
| | | T3 | 19 | 18 |
| *1-back task* | Red | T1 | 19 | 10 |
| | | T2 | 19 | 12 |
| | | T3 | 18 | 12 |
| | Blue | T1 | 19 | 12 |
| | | T2 | 15 | 13 |
| | | T3 | 18 | 13 |
| | White | T1 | 16 | 16 |
| | | T2 | 14 | 20 |
| | | T3 | 18 | 17 |
| *Go/no-go (GNG) task* | Red | T1 | 21 | 9 |
| | | T2 | 20 | 10 |
| | | T3 | 16 | 11 |
| | Blue | T1 | 19 | 12 |
| | | T2 | 15 | 13 |
| | | T3 | 18 | 15 |
| | White | T1 | 16 | 19 |
| | | T2 | 13 | 18 |
| | | T3 | 17 | 15 |
| *Subjective scale outcomes* | | | | |
| *Sleepiness (KSS)* | Red | T1 | 30 | 9 |
| | | T2 | 29 | 9 |
| | | T3 | 29 | 12 |

| Outcome/ Shift type | Light color | Time | Participants included in analyses (n) | |
|---|---|---|---|---|
| | | | Day shift | Night shift |
| | Blue | T1 | 30 | 13 |
| | | T2 | 28 | 13 |
| | | T3 | 27 | 13 |
| | White | T1 | 33 | 18 |
| | | T2 | 33 | 18 |
| | | T3 | 31 | 18 |
| *Sleep quality (PSQI): Baseline* | Red | — | 34 | 20 |
| | Blue | — | 30 | 24 |
| | White | — | 31 | 23 |
| *Sleep quality (PSQI): Intervention* | Red | — | 31 | 31 |
| | Blue | — | 27 | 23 |
| | White | — | 30 | 22 |
| *Sleep disturbance (PROMIS-SD): Baseline* | Red | — | 32 | 20 |
| | Blue | — | 26 | 22 |
| | White | — | 32 | 23 |
| *Sleep disturbance (PROMIS-SD): Intervention* | Red | — | 31 | 20 |
| | Blue | — | 26 | 20 |
| | White | — | 31 | 23 |
| *Global health (PROMIS-GH), physical: Baseline* | Red | — | 30 | 17 |
| | Blue | — | 23 | 21 |
| | White | — | 33 | 22 |
| *Global health (PROMIS-GH), physical: Intervention* | Red | — | 29 | 17 |
| | Blue | — | 22 | 20 |
| | White | — | 33 | 21 |
| *Global health (PROMIS-GH), mental: Baseline* | Red | — | 30 | 17 |
| | Blue | — | 23 | 21 |
| | White | — | 33 | 22 |
| *Global health (PROMIS-GH), mental: Intervention* | Red | — | 28 | 17 |
| | Blue | — | 22 | 20 |
| | White | — | 31 | 21 |

*Supplementary Table 2. Pairwise comparisons for shift type × time interactions (by shift type).*

| Shift type | Time (pairs) | | Mean difference | Std. error | df | *p* | *t* |
|---|---|---|---|---|---|---|---|
| *Psychomotor vigilance test (PVT) task response time* | | | | | | | |
| Day | 2 | 1 | 0.050 | 0.025 | 188.651 | 0.051 | 2.000 |
| | | 3 | 0.067 | 0.025 | 178.634 | ***0.008*** | 2.680 |
| | 3 | 1 | -0.018 | 0.024 | 235.746 | 0.451 | -0.750 |
| | | 2 | -0.067 | 0.025 | 178.634 | ***0.008*** | -2.680 |
| Night | 1 | 2 | 0.059 | 0.028 | 190.756 | ***0.039*** | 2.107 |
| | | 3 | 0.039 | 0.027 | 230.054 | 0.151 | 1.444 |
| | 2 | 1 | -0.059 | 0.028 | 190.756 | ***0.039*** | -2.107 |
| | | 3 | -0.02 | 0.028 | 192.748 | 0.479 | -0.714 |
| *1-back accuracy rate* | | | | | | | |
| Day | 1 | 2 | -0.048 | 0.014 | 180.597 | ***0.001*** | -3.429 |
| | | 3 | -0.006 | 0.014 | 216.533 | 0.640 | -0.429 |
| | 2 | 1 | 0.048 | 0.014 | 180.597 | ***0.001*** | 3.429 |
| | | 3 | 0.041 | 0.014 | 169.620 | ***0.004*** | 2.929 |

*Supplementary Table 3. Pairwise comparisons for time × shift type interactions (by time).*

| Time | Shift type (pairs) | | Mean difference | Std. error | df | *p* | *t* |
|---|---|---|---|---|---|---|---|
| *Psychomotor vigilance test (PVT) task* | | | | | | | |
| 1 | Day | Night | -0.045 | 0.025 | 232.045 | 0.078 | -1.800 |
| 2 | Day | Night | 0.064 | 0.025 | 232.861 | ***0.012*** | 2.560 |
| 3 | Day | Night | -0.023 | 0.024 | 232.733 | 0.34 | -0.958 |
| *1-back accuracy rate* | | | | | | | |
| 1 | Day | Night | -0.009 | 0.015 | 191.518 | 0.542 | -0.600 |
| 2 | Day | Night | 0.047 | 0.015 | 182.599 | ***0.002*** | 3.133 |
| 3 | Day | Night | 0.006 | 0.014 | 184.067 | 0.689 | 0.429 |

*Supplementary Table 4. Pairwise comparisons for light color.*

| Light color (pairs) | | Mean difference | Std. error | df | *p* | *t* |
|---|---|---|---|---|---|---|
| *Psychomotor vigilance test (PVT) task hit rate* | | | | | | |
| Dim white | Blue | 0.002 | 0.007 | 129.999 | 0.718 | 0.286 |
| | Red | 0.017 | 0.007 | 152.386 | ***0.017*** | 2.429 |
| *Sleep disturbance (PROMIS-SD)* | | | | | | |
| Dim white | Blue | 0.002 | 0.007 | 129.999 | 0.718 | 0.286 |
| | Red | 0.017 | 0.007 | 152.386 | ***0.017*** | 2.429 |

*Supplementary Table 5. Pairwise comparisons for shift type × light color × time interaction (by shift type).*

| Shift type | Light color | Time (pairs) | | Mean difference | Std. error | df | *p* | *t* |
|---|---|---|---|---|---|---|---|---|
| *1-back task: Response time* | | | | | | | | |
| Day | Red | 1 | 2 | 0.075 | 0.044 | 91.072 | 0.091 | 1.710533 |
| | | | 3 | 0.098 | 0.042 | 123.976 | ***0.021*** | 2.354134 |
| | | 2 | 1 | -0.075 | 0.044 | 91.072 | 0.091 | -1.71053 |
| | | | 3 | 0.023 | 0.045 | 102.365 | 0.619 | 0.508419 |
| Night | Red | 1 | 2 | 0.107 | 0.043 | 76.021 | ***0.015*** | 2.488372 |
| | | | 3 | 0.007 | 0.042 | 115.966 | 0.864 | 0.166667 |
| | | 2 | 1 | -0.107 | 0.043 | 76.021 | ***0.015*** | -2.48837 |
| | | | 3 | -0.100 | 0.042 | 72.833 | ***0.020*** | -2.38095 |
| | Dim white | 1 | 2 | 0.109 | 0.034 | 76.987 | ***0.002*** | 3.205882 |
| | | | 3 | 0.087 | 0.034 | 115.989 | ***0.013*** | 2.558824 |
| | | 2 | 1 | -0.109 | 0.034 | 76.987 | ***0.002*** | -3.20588 |
| | | | 3 | -0.022 | 0.034 | 73.276 | 0.521 | -0.64706 |
| *1-back task: Correct match response time* | | | | | | | | |
| Night | Blue | 1 | 2 | 0.134 | 0.061 | 71.964 | ***0.032*** | 2.196721 |
| | | | 3 | -0.041 | 0.065 | 88.355 | 0.524 | -0.63077 |
| | | 2 | 1 | -0.134 | 0.061 | 71.964 | ***0.032*** | -2.19672 |
| | | | 3 | -0.175 | 0.060 | 72.837 | ***0.005*** | -2.91667 |
| | Dim white | 1 | 2 | 0.110 | 0.052 | 72.423 | ***0.038*** | 2.115385 |
| | | | 3 | 0.139 | 0.057 | 91.692 | ***0.016*** | 2.438596 |
| | | 2 | 1 | -0.110 | 0.052 | 72.423 | ***0.038*** | -2.11538 |
| | | | 3 | 0.029 | 0.053 | 71.816 | 0.580 | 0.54717 |
| *1-back task: Correct no-match response time* | | | | | | | | |
| Day | Red | 1 | 2 | 0.062 | 0.042 | 85.686 | 0.145 | 1.47619 |
| | | | 3 | 0.106 | 0.043 | 117.507 | ***0.015*** | 2.465116 |
| | | 2 | 1 | -0.062 | 0.042 | 85.686 | 0.145 | -1.47619 |
| | | | 3 | 0.045 | 0.045 | 95.289 | 0.319 | 1.000000 |
| Night | Dim white | 1 | 2 | 0.094 | 0.037 | 81.959 | ***0.014*** | 2.540541 |
| | | | 3 | 0.090 | 0.039 | 119.763 | ***0.024*** | 2.307692 |
| | | 2 | 1 | -0.094 | 0.037 | 81.959 | ***0.014*** | -2.54054 |
| | | | 3 | -0.003 | 0.037 | 82.555 | 0.927 | -0.08108 |

*Supplementary Table 6. Pairwise comparisons for shift type × light color × time interaction (by time).*

| Time | Shift type | Light color (pairs) | | Mean difference | Std. error | df | *p* | *t* |
|---|---|---|---|---|---|---|---|---|
| *1-back task: Response time* | | | | | | | | |
| 3 | Day | Dim white | Blue | 0.061 | 0.028 | 19.268 | ***0.038*** | 2.178571 |
| | | | Red | 0.142 | 0.040 | 50.255 | ***0.001*** | 3.55 |
| | Night | Dim white | Blue | -0.047 | 0.029 | 16.186 | 0.121 | -1.62069 |
| | | | Red | -0.015 | 0.045 | 44.683 | 0.734 | -0.33333 |

| Time | Shift type | Light color (pairs) | | Mean difference | Std. error | df | *p* | *t* |
|---|---|---|---|---|---|---|---|---|
| *1-back task: Correct match response time* | | | | | | | | |
| 1 | Day | Dim white | Blue | -0.136 | 0.052 | 55.177 | ***0.011*** | -2.61538 |
| | | | Red | -0.052 | 0.050 | 54.048 | 0.298 | -1.04 |
| | Night | Dim white | Blue | 0.032 | 0.052 | 36.096 | 0.541 | 0.615385 |
| | | | Red | 0.148 | 0.055 | 39.770 | ***0.011*** | 2.690909 |
| 2 | Day | Dim white | Blue | -0.161 | 0.063 | 83.197 | ***0.013*** | -2.55556 |
| | | | Red | -0.126 | 0.058 | 65.617 | ***0.033*** | -2.17241 |
| | Night | Dim white | Blue | -0.150 | 0.048 | 22.397 | ***0.005*** | -3.125 |
| | | | Red | 0.044 | 0.067 | 51.726 | 0.520 | 0.656716 |
| *1-back task: Correct no-match response time* | | | | | | | | |
| 3 | Day | Dim white | Blue | 0.050 | 0.039 | 45.169 | 0.205 | 1.282051 |
| | | | Red | 0.144 | 0.040 | 54.812 | ***0.001*** | 3.6 |

*Supplementary Table 7. 1-back response time task pairwise comparisons for shift type × light color × time interaction (by time).*

| Time | Light color | Shift type (pairs) | | Mean difference | Std. error | df | *p* | *t* |
|---|---|---|---|---|---|---|---|---|
| 3 | Blue | Day | Night | -0.014 | 0.040 | 86.639 | 0.720 | -0.35 |
| | Red | Day | Night | -0.063 | 0.046 | 75.560 | 0.175 | -1.36957 |
| | Dim white | Day | Night | 0.094 | 0.038 | 88.996 | ***0.016*** | 2.473684 |

*Supplementary Table 8. Pairwise comparisons for shift type × light color interaction (by shift type)*

| Shift type | Light color (pairs) | | Mean difference | Std. error | df | *p* | *t* |
|---|---|---|---|---|---|---|---|
| *1-back task: Accuracy rate* | | | | | | | |
| Day | Dim white | Blue | -0.013 | 0.013 | 108.375 | 0.310 | -1.000 |
| | | Red | 0.037 | 0.013 | 139.999 | ***0.005*** | 2.846 |
| *1-back task: Number of correct no-matches* | | | | | | | |
| Night | Dim white | Blue | 0.026 | 0.013 | 83.814 | ***0.048*** | 2.000 |
| | | Red | -0.009 | 0.014 | 115.916 | 0.502 | -0.643 |
| *GNG task: Response time* | | | | | | | |
| Day | Dim white | Blue | -0.048 | 0.018 | 124.654 | ***0.010*** | -2.667 |
| | | Red | -0.035 | 0.018 | 155.223 | 0.051 | -1.944 |

*Supplementary Table 9. Pairwise comparisons for shift type × light color interaction (by light color)*

| Light color | Shift type (pairs) | | Mean difference | Std. error | df | *p* | *t* |
|---|---|---|---|---|---|---|---|
| *1-back task: Accuracy rate* | | | | | | | |
| Blue | Day | Night | 0.042 | 0.014 | 131.212 | ***0.003*** | 3.000 |
| Red | Day | Night | -0.025 | 0.014 | 121.869 | 0.082 | -1.786 |
| Dim white | Day | Night | 0.027 | 0.013 | 128.409 | ***0.048*** | 2.077 |
| *GNG task: Response time* | | | | | | | |
| Dim white | Day | Night | -0.059 | 0.018 | 135.165 | ***0.002*** | -3.278 |
| | Night | Day | 0.059 | 0.018 | 135.165 | ***0.002*** | 3.278 |

*Supplementary Table 10. 1-back task number of correct no-matches pairwise comparisons for time*

| Time (pairs) | | Mean difference | Std. error | df | *p* | *t* |
|---|---|---|---|---|---|---|
| 1 | 2 | -0.029 | 0.010 | 174.503 | ***0.007*** | -2.900 |
| | 3 | -0.010 | 0.010 | 233.315 | 0.309 | -1.000 |
| 2 | 1 | 0.029 | 0.010 | 174.503 | ***0.007*** | 2.900 |
| | 3 | 0.018 | 0.010 | 171.468 | 0.076 | 1.800 |

*Supplementary Table 11. GNG task false positive pairwise comparisons for shift type.*

| Shift type (pairs) | | Mean difference | Std. error | df | *p* | *t* |
|---|---|---|---|---|---|---|
| Day | Night | 0.008 | 0.004 | 98.013 | ***0.021*** | 2.000 |

*Supplementary Table 12. Subjective sleepiness (KSS) pairwise comparisons for time × light color interaction (by light color).*

| Light Color | Time (pairs) | | Mean difference | Std. error | df | *p* | *t* |
|---|---|---|---|---|---|---|---|
| Blue | T1 | T2 | 0.129 | 0.037 | 268.067 | ***0.001*** | 3.516453 |
| | | T3 | 0.069 | 0.041 | 386.396 | 0.096 | 1.675382 |
| | T2 | T1 | -0.129 | 0.037 | 268.067 | ***0.001*** | -3.51645 |
| | | T3 | -0.060 | 0.037 | 263.702 | 0.108 | -1.6066 |

*Supplementary Table 13. Subjective sleepiness (KSS) pairwise comparisons for time × light color interaction (by time).*

| Time | Light color (pairs) | | Mean difference | Std. error | df | *p* | *t* |
|---|---|---|---|---|---|---|---|
| T1 | Blue | Dim white | 0.129 | 0.042 | 292.602 | ***0.002*** | 3.059591 |
| | Red | Dim white | 0.019 | 0.043 | 354.380 | 0.659 | 0.443403 |

*Supplementary Table 14. Sleep disturbance (PROMIS-SD) pairwise comparisons for the main effect of light color.*

| Light color (pairs) | | Mean Difference | Std. Error | df | *p* | *t* |
|---|---|---|---|---|---|---|
| white | blue | 1.199 | 0.520 | 232.315 | ***0.022*** | 2.305997 |
| | red | 0.990 | 0.522 | 176.958 | 0.060 | 1.896534 |