**A Web-based Mindfulness Stress Management Program in a Corporate Call Center: A Randomized Clinical Trial to Evaluate the Added Benefit of On-site Group Support**

**Supplementary Material**

**Supplemental Methods: Sensitivity analyses**

Given that missing data may pose a threat to internal validity, we performed a sensitivity analysis using last observation carried forward (LOCF) to evaluate the robustness of our results. This method is a way to impute data and a conservative approach that assumes no improvement for dropouts. The choice of LOCF is a reasonable assumption for our study given that dropouts showed less online activity than active participants, and even participants in the control group still showed some, albeit marginal, improvement (**Table 2**). Results are shown in **Table S1** for within-group changes and comparisons and **Table S2** for between-group comparisons.

Overall results remained relatively the same when running sensitivity analysis using LOCF (**Table S1 and S2**). Significant group by time interaction was still observed for perceived stress (F(8,174), p=0.004), emotional well-being (F(8,160)=4.37, p=0.0001) and vitality (F(8,171)=2.66, p=0.009), while interaction for emotional role functioning was close to significant (F(8,172)=1.78, p=0.08).

 *Post-hoc* contrasts revealed that the improvement for WSM as well as SFN plus group support (WSMg) compared to control remained significant (or close to significant) (**Table S2**) for most of the same measures as the mixed model analysis performed on all available data (**Table 3)**. However amplitude of improvement was smaller, with a decrease in effect size by about 1/3 to 1/2 from large to moderate (**Table S2**), as a result of the assumption of no improvement for dropouts. Likewise, there was no major change in significance level for improvements brought by group support (WSMg vs. WSM) while effect size was reduced by about 20% when missing data was imputed using LOCF. Comparison of improvement between WSMg1 and WSMg2 also remained non-significant except for mindfulness at week 16 (p=0.04 compared to 0.11) with a reduction in effect size from 0.48 to 0.37.

In summary, the sensitivity analysis shows that overall, most important results regarding the benefit of SFN with group support remain, even though effect sizes decrease somewhat but remain clinically significant and similar to other conventional and web-based mindfulness programs ([1-4](#_ENREF_1)).

**Correction for Multiple Comparisons**

To avoid type II errors, we decided not to correct for multiple comparisons and discuss results in light of this assumption as suggested by Rothman *et al* ([5](#_ENREF_5)). If one adopts a conservative significance level for our 4-study-group trial (e.g., p=0.05/4~0.01 for the contrast comparisons and p=0.05/9~0.005 for all pair-wise comparisons), within-group comparison results with medium effect size remain statistically significant, as are most contrasts that compare effects to control (WSM and WSMg vs. control). The consistent pattern and frequency of improvements among outcomes suggests that the results that are no longer significant after correction are most likely not the results of pure statistical type I errors. In particular, there seems to be a greater improvement with online program plus group support than online program alone or control. Future, more adequately powered studies may confirm this finding.

**TABLE S1.** Sensitivity Analysis using Mixed Model With Missing Data Imputed Using LOCF

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  | **Descriptive statistics** |  | **Within Group Change from Baseline** |
|  |  |  | **Baseline** | **8 weeks** | **16 weeks** | **1 year** |  | **8 weeks** | **16 weeks** | **1 year** |
|   |   | **N** | **Mean (SD)** | **Mean (SD)** | **Mean (SD)** | **Mean (SD)** |  | **Mean (SE)** | **d** | **Mean (SE)** | **d** | **Mean (SE)** | **d** |
| **Perceived Stress (PSS)** |  |  |  |  |  |  |  |  |  |  |
|  | CTL | 37 | 25.4 (5.7) | 24.2 (6.6) | 23.6 (6.5) |  |  | -1.2 (0.6)\* | 0.2 | -1.8 (0.9)\* | 0.3 |  |  |
|  | WSM | 54 | 25.6 (5.4) | 22.4 (7.0) | 21.8 (7.7) | 22.1 (7.8) |  | -3.2 (0.7)\*\*\* | 0.6 | -3.8 (0.7)\*\*\* | 0.7 | -3.5 (0.7)\*\*\* | 0.7 |
|  | WSM1 | 37 | 24.5 (5.8) | 18.6 (6.2) | 17.9 (6.7) | 19.9 (7.4) |  | -5.9 (1.1)\*\*\* | 1.1 | -6.6 (1.0)\*\*\* | 1.2 | -4.6 (1.1)\*\*\* | 0.8 |
|   | WSM2 | 33 | 24.5 (5.1) | 19.6 (7.9) | 20.4 (7.8) | 20.0 (9.1) |   | -4.9 (1.1)\*\*\* | 0.9 | -4.2 (1.0)\*\*\* | 0.8 | -4.6 (1.3)\*\*\* | 0.8 |
| **Exhaustion (MBI-Ex)** |  |  |  |  |  |  |  |  |  |  |
|  | CTL | 37 | 3.74 (1.65) | 3.69 (1.55) | 3.69 (1.5) |  |  | -0.05 (0.11) | 0.0 | -0.05 (0.13) | 0.1 |  |  |
|  | WSM | 54 | 4.36 (1.37) | 4.11 (1.5) | 3.99 (1.58) | 4.03 (1.63) |  | -0.25 (0.12)\* | 0.2 | -0.37 (0.15)\* | 0.3 | -0.33 (0.15)\* | 0.2 |
|  | WSM1 | 37 | 3.83 (1.62) | 3.22 (1.71) | 3.08 (1.78) | 3.29 (1.69) |  | -0.61 (0.17)\*\*\* | 0.4 | -0.75 (0.19) \*\*\* | 0.5 | -0.54 (0.21)\* | 0.4 |
|   | WSM2 | 33 | 4.32 (1.23) | 3.77 (1.54) | 3.81 (1.51) | 3.91 (1.63) |   | -0.55 (0.15)\*\*\* | 0.4 | -0.51 (0.14)\*\*\* | 0.3 | -0.41 (0.17)\* | 0.3 |
| **Professional Efficacy (MBI-PE)** |  |  |  |  |  |  |  |  |  |  |
|  | CTL | 37 | 4.35 (1.27) | 4.31 (1.15) | 4.25 (1.07) |  |  | -0.04 (0.13) | -0.0 | -0.09 (0.16) | -0.1 |  |  |
|  | WSM | 54 | 4.22 (1.09) | 4.42 (1.12) | 4.20 (1.31) | 4.21 (1.27) |  | 0.19 (0.10)† | 0.2 | -0.02 (0.13) | -0.0 | -0.01 (0.14) | -0.0 |
|  | WSM1 | 37 | 4.32 (1.12) | 4.65 (1.14) | 4.71 (1.06) | 4.58 (1.23) |  | 0.34 (0.13)\* | 0.3 | 0.40 (0.12)\*\* | 0.3 | 0.27 (0.15)† | 0.2 |
|   | WSM2 | 33 | 4.47 (1.23) | 4.69 (1.14) | 4.59 (1.11) | 4.43 (1.38) |   | 0.21 (0.1)\* | 0.2 | 0.11 (0.10) | 0.1 | -0.04 (0.11) | -0.0 |
| **Mindfulness (MAAS)** |  |  |  |  |  |  |  |  |  |  |
|  | CTL | 37 | 3.48 (0.89) | 3.59 (0.94) | 3.68 (1.00) |  |  | 0.11 (0.09) | 0.1 | 0.20 (0.09)\* | 0.2 |  |  |
|  | WSM | 54 | 3.2 (0.87) | 3.36 (1.01) | 3.4 (1.03) | 3.38 (1.11) |  | 0.16 (0.07)\* | 0.2 | 0.20 (0.10)† | 0.2 | 0.18 (0.11)† | 0.2 |
|  | WSM1 | 37 | 3.54 (1.17) | 4.01 (1.01) | 4.14 (1.06) | 4.08 (1.1) |  | 0.47 (0.13)\*\*\* | 0.5 | 0.60 (0.13)\*\*\* | 0.6 | 0.54 (0.15)\*\*\* | 0.6 |
|   | WSM2 | 33 | 3.28 (0.85) | 3.52 (0.87) | 3.53 (0.92) | 3.41 (0.94) |   | 0.24 (0.11) \* | 0.3 | 0.25 (0.1) \* | 0.3 | 0.13 (0.10) | 0.1 |
| **Emotional Well-Being (SF36)** |  |  |  |  |  |  |  |  |  |  |
|  | CTL | 37 | 48.4 (18.1) | 46.9 (19.9) | 46.1 (19.4) |  |  | -1.5 (1.9) | -0.1 | -2.4 (1.8) | -0.1 |  |  |
|  | WSM | 54 | 44.7 (20.0) | 50.1 (23.5) | 50.6 (23.8) | 49.6 (23.2) |  | 5.4 (1.4)\*\*\* | 0.3 | 5.9 (1.7)\*\*\* | 0.3 | 4.9 (1.7)\*\* | 0.3 |
|  | WSM1 | 37 | 53.0 (15.9) | 65.6 (19.3) | 65.8 (19.2) | 63.5 (20.6) |  | 12.6 (2.3)\*\*\* | 0.7 | 12.9 (2.3)\*\*\* | 0.7 | 10.5 (2.5)\*\*\* | 0.6 |
|   | WSM2 | 33 | 49.5 (17.4) | 59.3 (20.9) | 58.2 (21.7) | 56.7 (23.1) |   | 9.8 (2.3)\*\*\* | 0.5 | 8.7 (2.0)\*\*\* | 0.5 | 7.2 (2.6)\*\* | 0.4 |
| **Emotional Role Functioning (SF36)** |  |  |  |  |  |  |  |  |  |
|  | CTL | 36 | 30.6 (32.2) | 41.4 (36.3) | 43.2 (35.0) |  |  | 9.3 (5.4)† | 0.3 | 11.1 (6.1)† | 0.4 |  |  |
|  | WSM | 54 | 29.6 (32.8) | 40.7 (38.1) | 46.3 (40.1) | 43.8 (38.2) |  | 11.1 (4.4)\* | 0.4 | 16.7 (4.5)\*\*\* | 0.5 | 14.2 (4.3)\*\* | 0.5 |
|  | WSM1 | 37 | 30.6 (33.7) | 58.6 (40.4) | 63.1 (38.3) | 62.2 (42.4) |  | 27.9 (5.9)\*\*\* | 0.9 | 32.4 (6.5)\*\*\* | 1.0 | 31.5 (7.2)\*\*\* | 1.0 |
|   | WSM2 | 33 | 33.3 (26.4) | 58.6 (34.4) | 51.5 (34.5) | 50.0 (37.3) |   | 25.3 (6.0)\*\*\* | 0.8 | 18.2 (5.4)\*\* | 0.6 | 16.7 (6.2)\* | 0.5 |
| **Vitality (SF36)** |  |  |  |  |  |  |  |  |  |  |
|  | CTL | 37 | 28.8 (17.8) | 30.1 (20.0) | 28.9 (18.5) |  |  | 1.4 (2.0)† | 0.1 | 0.1 (2.2) | 0.0 |  |  |
|  | WSM | 54 | 22.8 (18.6) | 28.8 (23.1) | 30.5 (24.1) | 30.2 (23.6) |  | 6.0 (1.7)\*\*\* | 0.3 | 7.7 (2.1)\*\*\* | 0.4 | 7.5 (2.0)\*\*\* | 0.4 |
|  | WSM1 | 37 | 30.9 (18.5) | 43.5 (20.9) | 45.1 (22.0) | 42.2 (23.8) |  | 12.6 (2.5)\*\*\* | 0.7 | 14.2 (2.8)\*\*\* | 0.8 | 11.2 (2.9)\*\*\* | 0.6 |
|   | WSM2 | 33 | 31.8 (16.8) | 41.6 (22.0) | 40.8 (22.7) | 37.6 (23.3) |   | 9.8 (2.6)\*\*\* | 0.5 | 8.9 (2.5)\*\* | 0.5 | 5.8 (2.5)\* | 0.3 |
|  |  |  | **Descriptive statistics** |  | **Change from Baseline** |
|  |  |  | **Baseline** | **8 weeks** | **16 weeks** | **24 weeks** |  | **8 weeks** | **16 weeks** | **24 weeks** |
|   |   | **N** | **Mean (SD)** | **Mean (SD)** | **Mean (SD)** | **Mean (SD)** |  | **Mean (SE)** | **d** | **Mean (SE)** | **d** | **Mean (SE)** | **d** |
| **Productivity Score (1=high, 5=low)** |  |  |  |  |  |  |  |  |  |
|  | CTL | 26 | 2.62 (0.64) | 2.69 (0.50) | 2.71 (0.62) | 2.58 (0.70) |  | 0.07 (0.06) | -0.1 | 0.08 (0.09) | -0.2 | -0.05 (0.10) | 0.1 |
|  | WSM | 27 | 2.56 (0.48) | 2.69 (0.41) | 2.37 (0.57) | 2.46 (0.59) |  | 0.13 (0.07)† | -0.2 | -0.19 (0.11)† | 0.4 | -0.10 (0.11) | 0.2 |
|  | WSM1 | 24 | 2.61 (0.56) | 2.68 (0.39) | 2.51 (0.75) | 2.41 (0.63) |  | 0.08 (0.09) | -0.1 | -0.09 (0.13) | 0.2 | -0.20 (0.10)† | 0.4 |
|   | WSM2 | 24 | 2.65 (0.49) | 2.62 (0.58) | 2.60 (0.66) | 2.43 (0.70) |   | -0.03 (0.09) | 0.1 | -0.05 (0.10) | 0.1 | -0.22 (0.13)† | 0.4 |

LOCF = Last Observation Carried Forward. CTL = Control; WSM = Web-based stress management; WSMg1 = Web-based stress management + group support; WSMg2 = Web-based stress management + group and expert support. PSS = Perceived Stress Scale, MBI-Ex = Maslach Burnout Inventory – Exhaustion Subscale, MBI-PE = Maslach Burnout Inventory – Professional Efficacy Subscale, SF36 = Rand SF36. SD = standard deviation, SE = standard error of the mean. d = Cohen’s d effect size calculated by dividing change from baseline by overall population standard deviation at baseline. Positive d means improvement; small, medium and large effect size for d≥0.3. 0.5 and 0.8 respectively.

† p<0.10, \* p<0.05, \*\* p<0.01 and \*\*\* p<0.001 for within group comparison from baseline on available data.

**TABLE S2.** Sensitivity Analysis With Missing Data Imputed Using LOCF – Group Comparisons of Treatment Effect from Baseline to 8 and 16 Weeks and 1 Year.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Outcome  F- and p-values for group x time interaction** | **8 weeks** |  | **16 weeks** |  |  **1 year** |
| **Comparison** | **Mean (SE)** | **p-value** | **d** |  | **Mean (SE)** | **p-value** | **d** |  | **Mean (SE)** | **p-value** | **d** |
| **Stress (PSS)  F(8,174)=3.0, p=0.004** |  |  |  |  |  |  |  |  |
| WSM vs CTL | -1.92 (1.16) | 0.1 | 0.4 |  | -1.92 (1.19) | 0.11 | 0.4 |  |  |  |  |
| WSMg vs CTL | -4.18 (1.11) | **0.0002** | 0.8 |  | -3.54 (1.13) | **0.002** | 0.7 |  |  |  |  |
| WSMg vs WSM | -2.26 (0.99) | **0.02** | 0.4 |  | -1.62 (1.01) | 0.11 | 0.3 |  | -1.06 (1.1) | 0.34 | 0.2 |
| WSMg2 vs WSMg1 | 1.00 (1.3) | 0.44 | -0.2 |  | 2.44 (1.33) | 0.07 | -0.5 |  | 0.01 (1.45) | 0.99 | 0.0 |
| **Exhaustion (MBI)  F(8,170)=1.62, p=0.12** |  |  |  |  |  |  |  |  |
| WSM vs CTL | -0.20 (0.19) | 0.29 | 0.1 |  | -0.31 (0.22) | 0.15 | 0.2 |  |  |  |  |
| WSMg vs CTL | -0.53 (0.18) | **0.003** | 0.4 |  | -0.57 (0.21) | **0.006** | 0.4 |  |  |  |  |
| WSMg vs WSM | -0.33 (0.16) | **0.04** | 0.2 |  | -0.26 (0.18) | 0.16 | 0.2 |  | -0.15 (0.2) | 0.46 | 0.1 |
| WSMg2 vs WSMg1 | 0.06 (0.21) | 0.77 | -0.0 |  | 0.24 (0.24) | 0.33 | -0.2 |  | 0.12 (0.26) | 0.64 | -0.1 |
| **Professional Efficacy (MBI)  F(8,172)=1.43, p=0.19** |  |  |  |  |  |  |
| WSM vs CTL | 0.23 (0.16) | 0.13 | 0.2 |  | 0.07 (0.18) | 0.7 | 0.1 |  |  |  |  |
| WSMg vs CTL | 0.31 (0.15) | **0.03** | 0.3 |  | 0.35 (0.17) | **0.04** | 0.3 |  |  |  |  |
| WSMg vs WSM | 0.08 (0.13) | 0.55 | 0.1 |  | 0.28 (0.15) | 0.07 | 0.2 |  | 0.12 (0.17) | 0.48 | 0.1 |
| WSMg2 vs WSMg1 | -0.12 (0.17) | 0.48 | -0.1 |  | -0.28 (0.2) | 0.16 | -0.3 |  | -0.31 (0.22) | 0.17 | -0.3 |
| **Emotional Well-Being (SF36)  F(8,160)=4.37, p=0.0001** |  |  |  |  |  |  |
| WSM vs CTL | 6.9 (2.6) | **0.007** | 0.4 |  | 8.3 (2.6) | **0.002** | 0.5 |  |  |  |  |
| WSMg vs CTL | 12.7 (2.4) | **<0.0001** | 0.7 |  | 13.1 (2.5) | **<0.0001** | 0.7 |  |  |  |  |
| WSMg vs WSM | 5.8 (2.2) | **0.008** | 0.3 |  | 4.8 (2.2) | **0.03** | 0.3 |  | 4.0 (2.5) | 0.12 | 0.2 |
| WSMg2 vs WSMg1 | -2.9 (2.9) | 0.31 | -0.2 |  | -4.2 (3) | 0.16 | -0.2 |  | -3.3 (3.3) | 0.32 | -0.2 |
| **Emotional Role Functioning (SF36)  F(8,172)=1.78, p=0.08** |  |  |  |  |  |  |
| WSM vs CTL | 1.0 (7.2) | 0.89 | 0.0 |  | 4.8 (7.5) | 0.52 | 0.2 |  |  |  |  |
| WSMg vs CTL | 16.5 (6.9) | **0.02** | 0.5 |  | 13.4 (7.2) | 0.06 | 0.4 |  |  |  |  |
| WSMg vs WSM | 15.5 (6.1) | **0.01** | 0.5 |  | 8.6 (6.4) | 0.18 | 0.3 |  | 9.9 (6.7) | 0.14 | 0.3 |
| WSMg2 vs WSMg1 | -2.7 (8) | 0.74 | -0.1 |  | -14.3 (8.4) | 0.09 | -0.5 |  | -14.9 (8.9) | 0.10 | -0.5 |
| **Vitality (SF36)  F(8,171)=2.66, p=0.009** |  |  |  |  |  |  |  |  |
| WSM vs CTL | 4.7 (2.9) | 0.11 | 0.3 |  | 7.6 (3.2) | **0.02** | 0.4 |  |  |  |  |
| WSMg vs CTL | 9.8 (2.8) | **0.0005** | 0.5 |  | 11.4 (3.1) | **0.0003** | 0.6 |  |  |  |  |
| WSMg vs WSM | 5.2 (2.5) | **0.04** | 0.3 |  | 3.8 (2.7) | 0.17 | 0.2 |  | 1.0 (2.8) | 0.71 | 0.1 |
| WSMg2 vs WSMg1 | -2.8 (3.2) | 0.39 | -0.2 |  | -5.2 (3.6) | 0.15 | -0.3 |  | -5.5 (3.7) | 0.14 | -0.3 |
| **Mindfulness (MAAS)  F(8,178)=1.46, p=0.18** |  |  |  |  |  |  |  |  |
| WSM vs CTL | 0.05 (0.13) | 0.73 | 0.1 |  | 0.00 (0.15) | 1 | 0.0 |  |  |  |  |
| WSMg vs CTL | 0.24 (0.12) | **0.05** | 0.3 |  | 0.22 (0.14) | 0.12 | 0.2 |  |  |  |  |
| WSMg vs WSM | 0.20 (0.11) | 0.08 | 0.2 |  | 0.22 (0.13) | 0.08 | 0.2 |  | 0.15 (0.14) | 0.26 | 0.2 |
| WSMg2 vs WSMg1 | -0.23 (0.15) | 0.11 | -0.2 |   | -0.35 (0.17) | **0.04** | -0.4 |   | -0.42 (0.18) | 0.02 | -0.4 |
|  | **8 weeks** |  | **16 weeks** |  | **24 weeks** |
| **Comparison** | **Mean (SE)** | **p-value** | **d** |  | **Mean (SE)** | **p-value** | **d** |  | **Mean (SE)** | **p-value** | **d** |
| **Productivity  F(9,98)=1.13, p=0.35** |  |  |  |  |  |  |  |  |
| WSM vs CTL | 0.06 (0.1) | 0.56 | -0.1 |  | -0.27 (0.15) | 0.08 | 0.5 |  | -0.05 (0.15) | 0.76 | 0.1 |
| WSMg vs CTL | -0.05 (0.09) | 0.62 | 0.1 |  | -0.15 (0.13) | 0.25 | 0.3 |  | -0.16 (0.14) | 0.24 | 0.3 |
| WSMg vs WSM | -0.11 (0.09) | 0.24 | 0.2 |  | 0.12 (0.13) | 0.39 | -0.2 |  | -0.11 (0.13) | 0.41 | 0.2 |
| WSMg2 vs WSMg1 | -0.11 (0.11) | 0.32 | 0.2 |  | 0.04 (0.16) | 0.8 | -0.1 |  | -0.02 (0.16) | 0.92 | 0.0 |

LOCF = Last Observation Carried Forward. CTL = Control; WSM = Web-based stress management; WSMg1 = Web-based stress management + group support; WSMg2 = Web-based stress management + group and expert support. Contrasts and results were computed from the mixed model analysis. Results shown as adjusted mean and standard error of the mean (SE) and relative effect size (Cohen’s d).

**TABLE** **S3.** Impact of program activity level and mindfulness on outcomes improvement at 16 weeks.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Correlation with weekly practice** |  | **Correlation with change in mindfulness**  |
|   | **ρ** | **p-value** |  | **ρ** | **p-value** |
| **Perceived Stress (PSS)** | -0.15 | 0.27 |  | **-0.25** | **0.06** |
| **Burnout - Exhaustion (MBI)** | **-0.25** | **0.06** |  | **-0.43** | **0.0007** |
| **Burnout - Professional Efficacy (MBI)** | 0.12 | 0.38 |  | 0.16 | 0.24 |
| **Emotional Well-Being (SF36)** | **0.35** | **0.01** |  | **0.41** | **0.001** |
| **Emotional Role Functioning (SF36)** | **0.26** | **0.05** |  | **0.40** | **0.002** |
| **Energy (SF36)** | 0.13 | 0.34 |  | **0.42** | **0.001** |
| **Mindfulness (MAAS)** | **0.37** | **0.005** |  | NA | NA |
| **Productivity score** | 0.05 | 0.74 |  | **0.24** | 0.14 |
| **Productivity score (at week 24)** | **-0.29** | **0.04** |  | -0.06 | 0.71 |
| **Group Attendance** | 0.25 | 0.09 |  |  |  |

ρ = Spearman correlation coefficient. Average weekly practice over the 8-week treatment collected at 8 weeks using recall. Change in mindfulness measured at 16 week. No correlation was found between group attendance and outcome.

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