# Supplementary Material

**The effects of a tailored mindfulness-based program on the positive mental health of resident physicians: a randomized controlled trial**

Supplementary Table 1

*Program contents*

| Week | Session theme | Summary of contents |
|---|---|---|
| 1 | Mindfulness | Exploring resident physicians' needs and expectations; introducing mindfulness as mode of being, as contrasted to a mode of doing and performing during everyday life. |
| 2 | Dealing with barriers and subjective perception of time | Discussing ways to deal with barriers to mindful practice; exploring mindful anchors in daily routine (e.g., mindful walking along hospital corridors; mindful stop before entering a patient's room; mindful hand disinfection); introducing mindfulness to experience slower passage of time and to mitigate the feeling of time pressure. |
| 3 | Dis-identification | Coping with painful emotions, thoughts and physical sensations; raise awareness of the process of constructing reality through one's experiences; connecting with the inner observer and exploring dis-identification to learn to non-identify with thoughts and feelings and to reduce reactivity towards them. |
| 4 | Stress | Discussing resident physicians' specific stressors; psychoeducation on physiological and psychological processes of stress; exploring how to cope with stress using mindfulness. |
| 5 | Acceptance | Learning acceptance of oneself as well as the given reality of experiences, events and working conditions. Exploring the difference between acceptance and resignation/fatalism and the importance of acceptance for self-care. |
| | Day of mindfulness | All-day silent retreat. Practicing mindfulness intensively; reinforcing mindfulness as a reliable tool in both everyday life and daily medical practice. |
| 6 | Mindfulness in patient contact | Using mindfulness in therapeutic interactions; building up a compassionate communication atmosphere with patients, even in moments of time pressure. Learning to listen mindfully and exploring the benefits of letting patients complete their agenda of concerns. |
| 7 | Self-care | Discussing why self-care is especially relevant to resident physicians and its connection to quality of care; exploring ways to take care of oneself in daily routine. |
| 8 | Meaning in work and mindfulness as part of life | Exploring what is meaningful in professional life and how meaning can be enhanced in health care. Reinforcing mindfulness as part of everyday life and daily medical practice. |

**Supplementary Material: Indirect Measures - Data Preparation**

**SC-IAT:** We used the data processing procedure described by Karpinski and Steinmann (2006). Trials with reaction times below 350 ms or above 1500 ms were excluded, and error responses were replaced by the block mean adding a 400 ms penalty. Participants with more than 20% missing or incorrect responses were excluded. From the cleaned data a D-score was calculated by subtracting the average response times of Block 4 (good + job as physician) and Block 2 (bad + job as physician) and dividing the result by the standard deviation of all correct response times within Block 2 and 4. Accordingly, values higher than 0 indicate a positive attitude towards the job as physician, whereas values less than 0 indicate a negative attitude. The split-third reliability was adequate ($r$ = .78).

**AMP**: Data processing included excluding trials with reaction times below 350 ms or above 3000 ms (see e.g., Richard et al., 2017). This upper limit was chosen because priming effects tend to decrease over time (Payne et al., 2005). Further, participants with more than 20% missing trials or those who used the same response key in more than 90% of the trials were excluded. From the cleaned data, the relative frequency of positive ratings of the Chinese pictograms was calculated, taking into account only those trials that included a prime referring to the job as physician. Split-half reliability for clinic-trials was adequate (r = .79).

**IPANAT:** Data processing involved averaging the ratings for each subscale of positive and negative adjectives. Cronbachs' alpha was low (IPANAT-PA: $\alpha$ = .48; IPANAT-NA: $\alpha$ = .59).

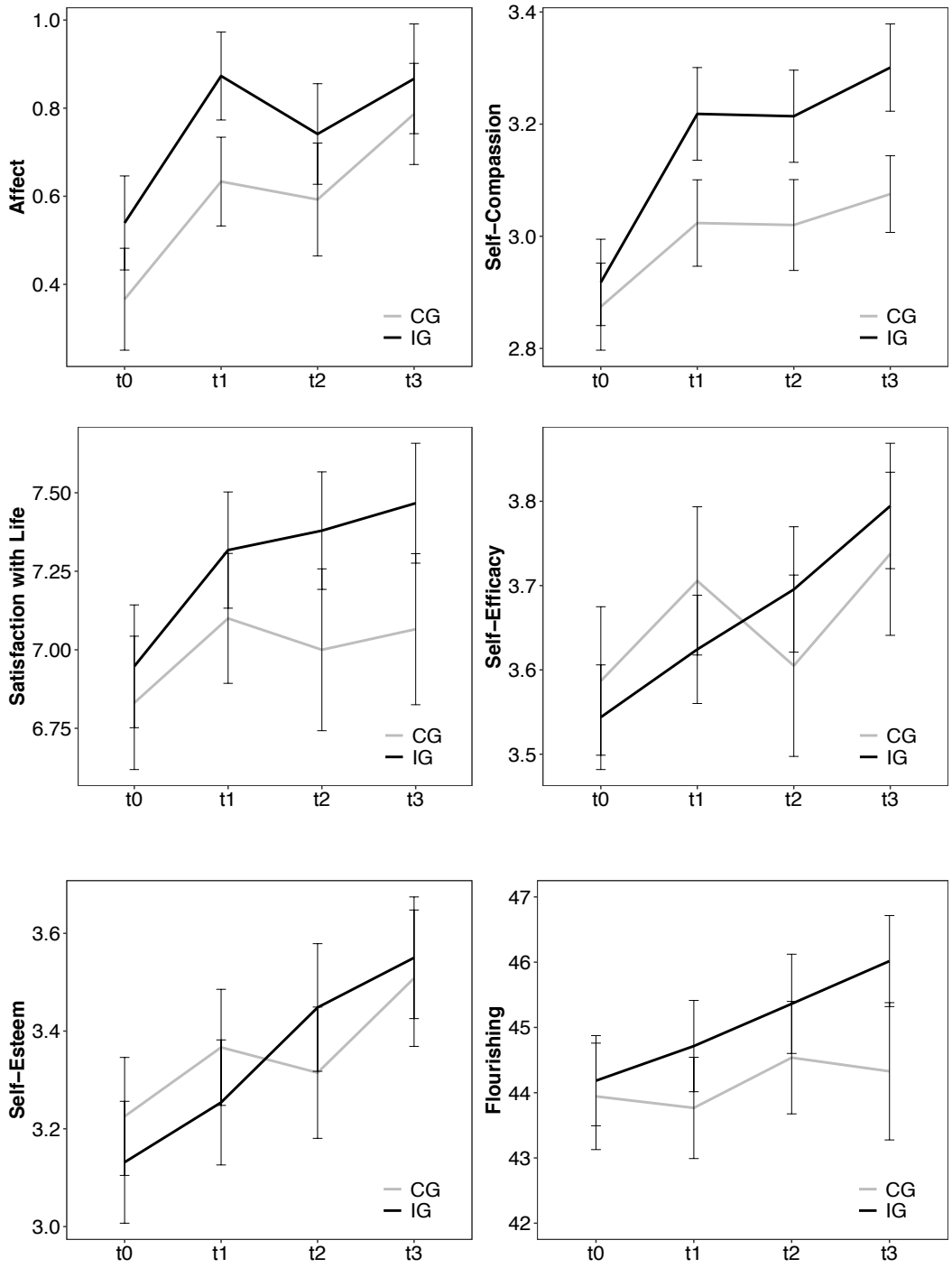
**WFT:** The data processing procedure was based on the procedure described in Johnson and others (2010). The completed words were first categorized into positive, negative, neutral, and not classifiable (i.e., due to spelling errors that made the word unintelligible). This categorization procedure was done by two independent raters. Participants who solved less than 50% of the items were excluded from the analysis (see e.g., Koopman et al., 2013). Next, a score for trait affectivity was calculated by dividing the

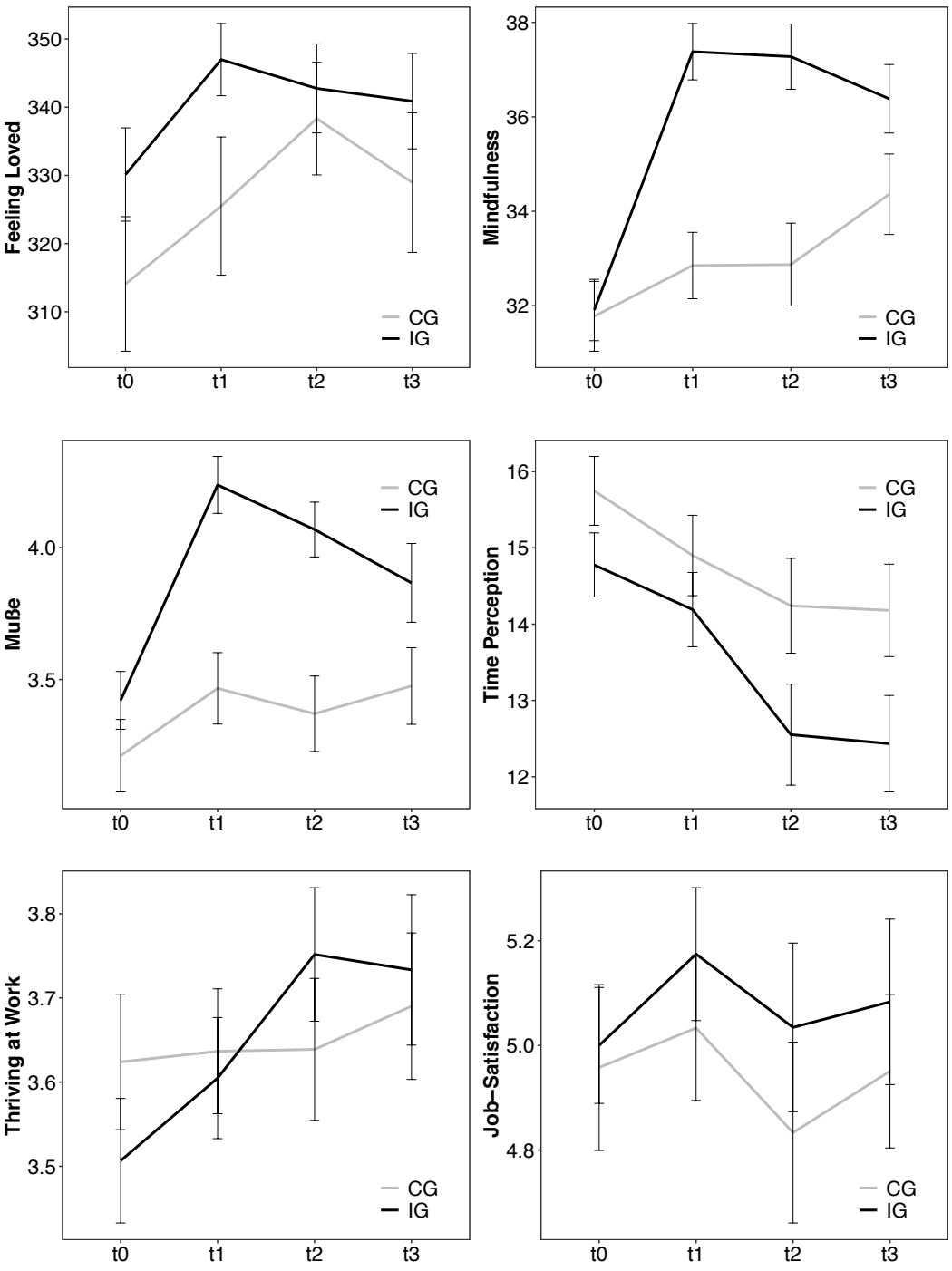
number of positive words by the sum of positive and negative words. In our version of the test we ignored neutral words. As a result, higher values represent higher positive trait affectivity. We did not determine the internal consistency because participants had the option of omitting items (see e.g., Koopman et al., 2013). Instead, we determined the test-retest reliabilities between t0 and the other time points (t1 r = .58, t2 r = .57, t3 r = .62).

**Supplementary Figures**

Supplementary Figure 1

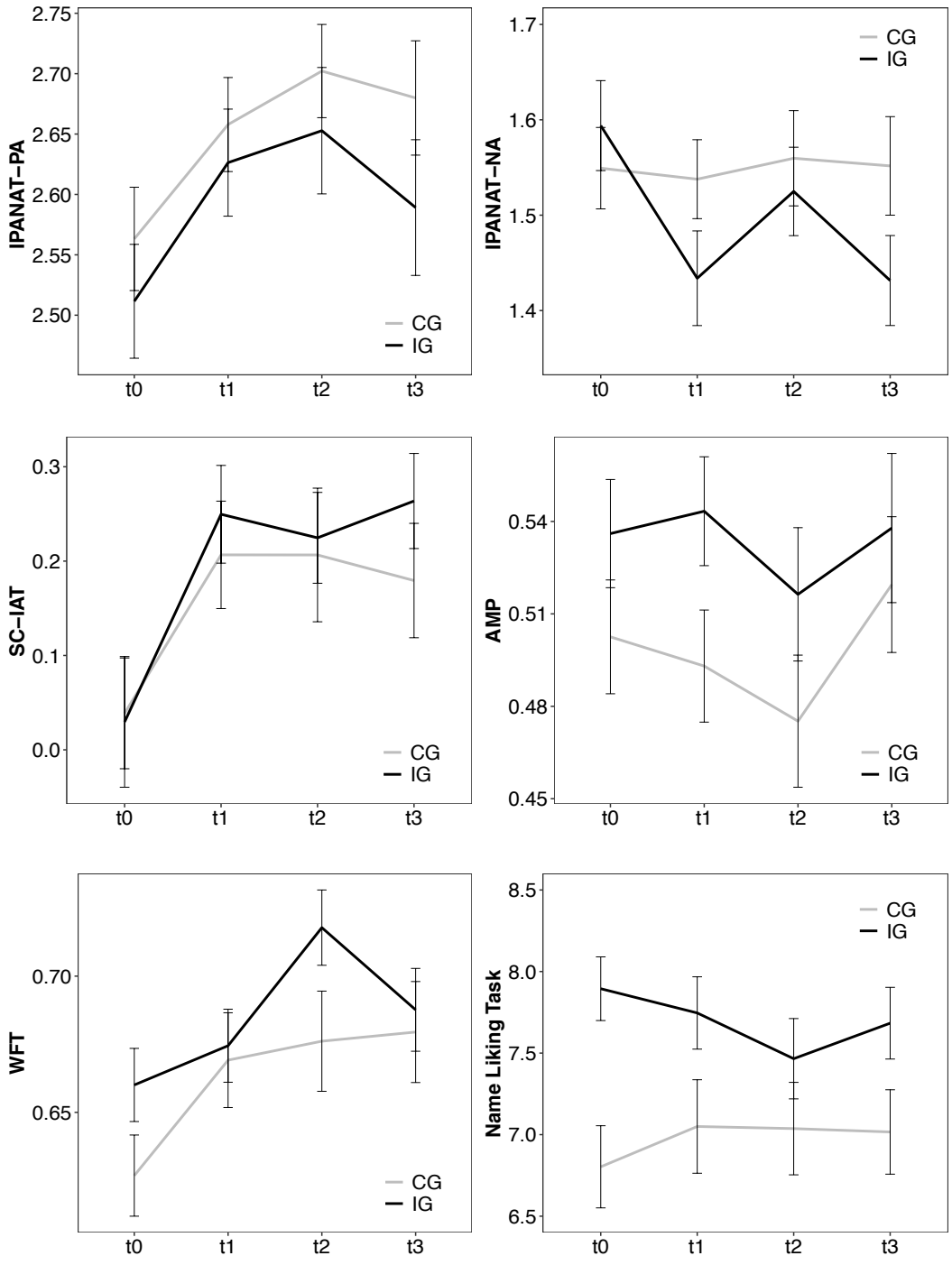
*Self-report measures: Change in positive mental health variables over time between groups*




Feeling Loved
350
340
330
320
310
t0
t1
t2
t3
CG
IG
Mindfulness
38
36
34
32
Mußе
4.0
3.5
Time Perception
16
15
14
13
12
Thriving at Work
3.8
3.7
3.6
3.5
Job−Satisfaction
5.2
5.0
4.8

Supplementary Figure 2

*Indirect measures: Change in positive mental health variables over time between groups*



Supplementary Table 2

*Adjusted within-group effect estimates in the intervention group for changes from baseline and overall effect across all time points*

| Measure | 2 Months t1 | | | 6 Months t2 | | | 12 Months t3 | | | Time[a] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MD[b] | p | d[c] | MD[b] | p | d[c] | MD[b] | p | d[c] | F | df | p |
| *Self-report measures* | | | | | | | | | | | | |
| Affect (SAM) | 0.38 (0.16, 0.61) | **.001** | 0.43 | 0.23 (0, 0.47) | .056 | 0.26 | 0.37 (0.14, 0.61) | **.003** | 0.41 | 4.71 | 3,178 | **.003** |
| Life-satisfaction (L1) | 0.44 (0.15, 0.73) | **.003** | 0.29 | 0.44 (0.09, 0.79) | **.015** | 0.29 | 0.54 (0.17, 0.91) | **.005** | 0.35 | 4.02 | 3,178 | **.008** |
| Self-compassion (SCS) | 0.32 (0.2, 0.43) | **<.0001** | 0.50 | 0.3 (0.16, 0.44) | **<.0001** | 0.47 | 0.35 (0.2, 0.5) | **<.0001** | 0.55 | 12.01 | 3,178 | **<.0001** |
| Self-esteem (SISE) | 0.13 (-0.07, 0.33) | .199 | 0.13 | 0.27 (0.05, 0.49) | **.016** | 0.26 | 0.37 (0.15, 0.59) | **.001** | 0.36 | 4.00 | 3,178 | **.009** |
| Flourishing (FS) | 0.92 (-0.1, 1.94) | .080 | 0.16 | 1.44 (0.23, 2.64) | **.021** | 0.25 | 2.06 (0.81, 3.31) | **.002** | 0.36 | 3.59 | 3,178 | **.015** |
| Feeling loved | 17.39 (7.05, 27.74) | **.001** | 0.36 | 12.47 (2.5, 22.45) | **.015** | 0.26 | 11.38 (1.21, 21.56) | **.030** | 0.24 | 4.13 | 3,178 | **.007** |
| Mindfulness (FMI) | 5.67 (4.57, 6.77) | **<.0001** | 1.05 | 5.35 (4.04, 6.67) | **<.0001** | 0.99 | 4.33 (2.95, 5.7) | **<.0001** | 0.80 | 37.15 | 3,178 | **<.0001** |
| Mußе | 0.79 (0.58, 1.09) | **<.0001** | 0.76 | 0.94 (0.7, 1.27) | **<.0001** | 0.90 | 0.56 (0.38, 0.83) | **.003** | 0.53 | 15.36 | 3,178 | **<.0001** |
| Time perception | -0.7 (-1.69, 0.28) | .163 | 0.16 | -2.36 (-3.38, -1.34) | **<.0001** | 0.54 | -2.45 (-3.46, -1.44) | **<.0001** | 0.57 | 10.91 | 3,178 | **<.0001** |
| Thriving at Work (TS) | 0.14 (0.03, 0.26) | **.017** | 0.23 | 0.14 (0.03, 0.26) | **.001** | 0.39 | 0.24 (0.11, 0.38) | **.001** | 0.39 | 5.16 | 3,178 | **.002** |
| Job-satisfaction (JS) | 0.2 (-0.05, 0.44) | .120 | 0.18 | 0.04 (-0.24, 0.32) | .793 | 0.03 | 0.07 (-0.21, 0.35) | .633 | 0.06 | 0.94 | 3,178 | .424 |
| Self-efficacy | 0.11 (0, 0.22) | **.043** | 0.21 | 0.18 (0.05, 0.3) | **.005** | 0.32 | 0.27 (0.14, 0.39) | **<.0001** | 0.49 | 6.32 | 3,178 | **<.0001** |
| *Indirect measures* | | | | | | | | | | | | |
| SC-IAT | 0.22 (0.08, 0.35) | **.003** | 0.46 | 0.2 (0.06, 0.34) | **.007** | 0.42 | 0.23 (0.08, 0.37) | **.002** | 0.48 | 4.53 | 3,152 | **0.005** |
| AMP | 0.02 (-0.02, 0.06) | .311 | 0.12 | 0 (-0.04, 0.05) | .854 | 0.03 | 0.01 (-0.04, 0.05) | .765 | 0.04 | 0.42 | 3,152 | 0.735 |
| IPANAT-PA | 0.1 (0.01, 0.19) | **.032** | 0.25 | 0.13 (0.03, 0.23) | **.013** | 0.33 | 0.07 (-0.03, 0.17) | .188 | 0.17 | 2.50 | 3,178 | 0.061 |
| IPANAT-NA | -0.15 (-0.23, -0.07) | **.001** | 0.38 | -0.05 (-0.13, 0.04) | .280 | 0.12 | 0.13 (-0.22, -0.05) | **.002** | 0.34 | 5.68 | 3,178 | **0.001** |
| WFT | 0.02 (0, 0.05) | .097 | 0.19 | 0.05 (0.02, 0.08) | **<.001** | 0.46 | 0.03 (0, 0.05) | .059 | 0.23 | 4.65 | 3,177 | **0.004** |
| Name Liking | -0.11 (-0.44, 0.21) | .494 | -0.07 | -0.11 (-0.44, 0.21) | .114 | -0.16 | -0.28 (-0.62, 0.06) | .420 | -0.16 | 0.84 | 3,178 | 0.472 |

*Note*. [a]MD = adjusted mean difference in change from baseline. [b] Cohen's d, positive values indicate improvement. [C] The overall model includes all time points from baseline. Bold indicates statistical significance (alpha = .05, two tailed)

Supplementary Table 3

*Adjusted within-group effect estimates in the control group for changes from baseline and overall effect across all time points*

| Measure | 2 Months t1 | | | 6 Months t2 | | | 12 Months t3 | | | Time[a] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MD[b] | p | d[c] | MD[b] | p | d[c] | MD[b] | p | d[c] | F | df | p |
| *Self-report measures* | | | | | | | | | | | | |
| Affect (SAM) | 0.21 (-0.02, 0.44) | .083 | 0.23 | 0.22 (-0.03, 0.47) | .082 | 0.25 | 0.41 (0.17, 0.65) | **.001** | 0.46 | 3.67 | 3,172 | **.013** |
| Life-satisfaction (L1) | 0.14 (0.24, 0.52) | .470 | 0.08 | 0.1 (-0.27, 0.47) | .596 | 0.07 | 0.16 (-0.19, 0.52) | .370 | 0.11 | 0.31 | 3,172 | .821 |
| Self-compassion (SCS) | 0.09 (-0.03, 0.21) | .160 | 0.14 | 0.1 (-0.02, 0.23) | .106 | 0.16 | 0.16 (0.04, 0.28) | **.012** | 0.24 | 2.22 | 3,172 | .087 |
| Self-esteem (SISE) | 0.03 (-0.15, 0.21) | .735 | 0.03 | 0.1 (-0.12, 0.31) | .375 | 0.09 | 0.23 (0.01, 0.45) | **.046** | 0.22 | 1.50 | 3,172 | .271 |
| Flourishing (FS) | -0.71 (-1.85, 0.44) | .230 | -0.10 | 0.27 (-1.05, 1.58) | .692 | 0.05 | -0.26 (-1.57, 1.04) | .694 | -0.05 | 0.99 | 3,172 | .398 |
| Feeling loved | 4.78 (-6.87, 16.43) | .423 | 0.07 | 18.59 (7.41, 29.77) | **.001** | 0.39 | 13.57 (2.47, 24.66) | **.018** | 0.28 | 4.64 | 3,172 | **.004** |
| Mindfulness (FMI) | 0.58 (-0.75, 1.91) | .397 | 0.09 | 0.94 (-0.53, 2.4) | .212 | 0.17 | 1.93 (0.51, 3.35) | **.009** | 0.36 | 2.40 | 3,172 | .070 |
| Mußе | 0.18 (-0.09, 0.46) | .191 | 0.16 | 0.13 (-0.16, 0.42) | .371 | 0.14 | 0.21 (-0.07, 0.49) | .148 | 0.22 | 0.89 | 3,172 | .450 |
| Time perception | -0.83 (-1.75, 0.09) | .079 | -0.20 | 1.26 (-2.34, -0.17) | **.025** | 0.29 | 1.65 (-2.76, -0.55) | **.004** | 0.38 | 3.05 | 3,172 | **.030** |
| Thriving at Work (TS) | -0.03 (-0.16, 0.1) | .672 | -0.04 | 0.02 (-0.13, 0.17) | .787 | 0.03 | 0.04 (-0.1, 0.18) | .591 | 0.06 | 0.30 | 3,172 | .828 |
| Job-satisfaction (JS) | -0.08 (-0.36, 0.2) | .592 | -0.06 | -0.08 (-0.37, 0.21) | .603 | -0.07 | 0.06 (-0.34, 0.22) | .678 | 0.05 | 0.13 | 3,172 | .941 |
| Self-efficacy | 0.06 (-0.07, 0.2) | .348 | 0.09 | 0.06 (-0.08, 0.2) | .390 | 0.12 | 0.13 (-0.01, 0.26) | .068 | 0.24 | 0.13 | 3,172 | .338 |
| *Indirect measures* | | | | | | | | | | | | |
| SC-IAT | 0.16 (0.01, 0.32) | **.038** | 0.34 | 0.16 (0, 0.32) | **.048** | 0.35 | 0.13 (-0.02, 0.29) | .094 | 0.29 | 1.96 | 3,135 | **.009** |
| AMP | -0.01 (-0.05, 0.03) | .798 | -0.03 | -0.03 (-0.07, 0.02) | .256 | -0.15 | 0.01 (-0.03, 0.06) | .604 | 0.07 | 1.05 | 3,142 | .372 |
| IPANAT-PA | 0.11 (0.02, 0.2) | **.014** | 0.33 | 0.15 (0.05, 0.24) | **.003** | 0.36 | 0.12 (0.03, 0.21) | **.009** | 0.30 | 3.94 | 3,172 | .161 |
| IPANAT-NA | -0.01 (-0.11, 0.09) | .883 | -0.02 | 0 (-0.1, 0.1) | .984 | 0.00 | 0.05 (-0.1, 0.1) | .999 | 0.13 | 0.01 | 3,172 | .999 |
| WFT | 0.03 (0, 0.06) | **.033** | 0.22 | 0.04 (0.01, 0.07) | **.008** | 0.37 | 0.04 (0.02, 0.07) | **.003** | 0.40 | 3.76 | 3,172 | **.012** |
| Name Liking | 0.23 (-0.14, 0.6) | .223 | 0.11 | 0.26 (-0.18, 0.69) | .246 | 0.15 | 0.14 (-0.3, 0.58) | .531 | 0.08 | 0.64 | 3,172 | .593 |

*Note*. [a]MD = adjusted mean difference in change from baseline. [b] Cohen's d, positive values indicate improvement. [C] The overall model includes all time points from baseline. Bold indicates statistical significance (alpha = .05, two tailed)

**Supplementary Material: Muße Questionnaire**

In the following we report the results of a more detailed analysis of the Muße questionnaire (adapted from: Heger, 2015) to distinguish between various contexts in which Muße was experienced. Descriptive statistics are displayed in Table 3.

From t0 to t1, there was a significant effect in terms of self-reported experience of Muße overall as well as Muße experienced during leisure time, at work, and when being alone. Similarly, from t0 to t2, we found a significant effect in terms of Muße overall, during leisure time, at work and when being alone. Moreover, from t0 to t3, we found a significant effect in terms of Muße at work. The results of the linear mixed models are displayed in Supplementary Table 4.

Supplementary Table 4

*Muße Questionnaire: Means and Standard Deviations*

| | **t0** | | **t1** | | **t2** | | **t3** | |
|---|---|---|---|---|---|---|---|---|
| **Measure** | IG n=76 M(SD) | CG n=71 M(SD) | IG n=63 M(SD) | CG n=60 M(SD) | IG n=58 M(SD) | CG n=54 M(SD) | IG n=60 M(SD) | CG n=61 M(SD) |
| *Muße* | | | | | | | | |
| Muße overall | 3.42 (0.96) | 3.21 (1.16) | 4.24 (0.86) | 3.47 (1.05) | 4.07 (0.79) | 3.37 (1.05) | 3.87 (1.16) | 3.48 (1.13) |
| during leisure time | 4.12 (0.98) | 4.01 (1.15) | 4.67 (0.86) | 3.98 (1.10) | 4.45 (0.78) | 3.81 (1.23) | 4.48 (0.95) | 4.11 (1.21) |
| at work | 2.26 (1.04) | 2.44 (1.10) | 3.25 (0.95) | 2.57 (1.18) | 3.12 (1.22) | 2.35 (1.08) | 2.82 (1.26) | 2.54 (1.19) |
| at home | 4.04 (1.05) | 3.76 (1.08) | 4.43 (1.01) | 3.88 (1.03) | 4.26 (0.69) | 3.67 (1.21) | 3.87 (1.00) | 4.05 (1.13) |
| when outside of home | 3.87 (1.00) | 3.55 (1.07) | 4.30 (0.82) | 3.72 (1.11) | 4.16 (0.87) | 3.59 (1.30) | 4.10 (0.97) | 3.56 (1.31) |
| when alone | 3.92 (0.95) | 3.62 (1.25) | 4.49 (0.95) | 3.80 (1.04) | 4.43 (0.77) | 3.70 (1.35) | 4.28 (0.98) | 4.07 (1.24 |
| when quiet | 4.01 (0.95) | 3.36 (1.28) | 4.48 (1.03) | 3.87 (1.13) | 4.34 (0.87) | 3.87 (1.37) | 4.25 (0.95) | 4.08 (1.16) |
| when moving | 4.26 (10.5) | 3.75 (1.39) | 4.33 (0.95) | 3.78 (1.37) | 4.12 (1.14) | 3.74 (1.29) | 4.38 (1.26) | 4.03 (1.33) |

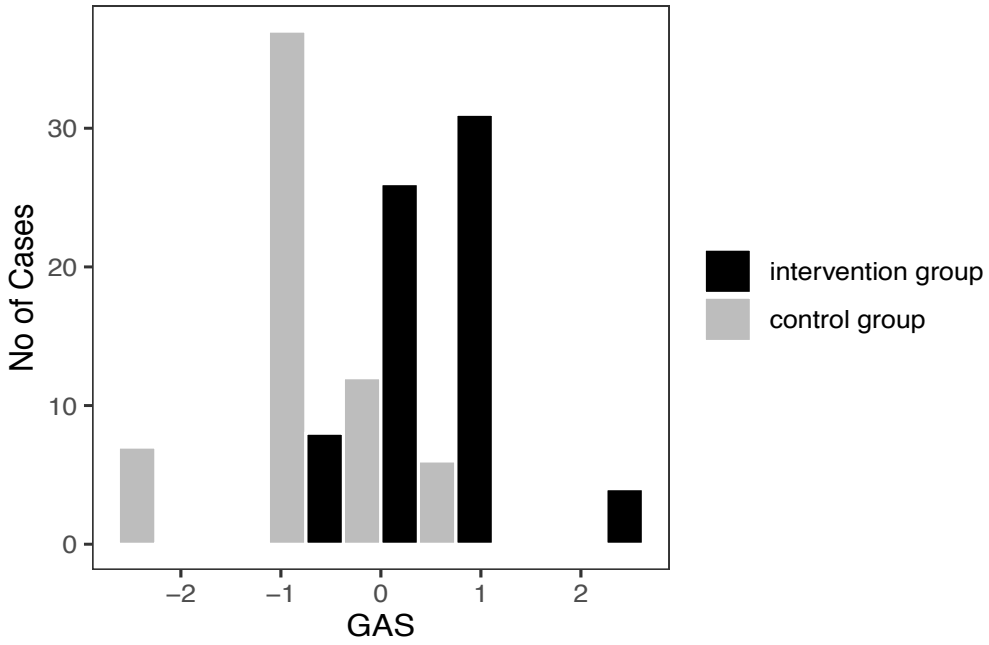
Supplementary Table 5

*Adjusted between-group effect estimates for changes from baseline and overall effect across all time points for the Mußе questionnaire*

| Measure | 2 Months t1 | | | 6 Months t2 | | | 12 Months t3 | | | Time[a] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MD[b] | p | d[c] | MD[b] | p | d[c] | MD[b] | p | d[c] | F | df | p |
| *Mußе* | | | | | | | | | | | | |
| Mußе overall | 0.64 (0.29, 1) | **>.0001** | 0.62 | 0.5 (0.11, 0.88) | **.013** | 0.48 | 0.23 (-0.15, 0.61) | .240 | 0.22 | 4.67 | 3,350 | **.003** |
| during leisure time | 0.67 (0.32, 1.01) | **.0002** | 0.64 | 0.54 (0.17, 0.9) | **.004** | 0.52 | 0.25 (-0.1, 0.61) | .167 | 0.24 | 5.52 | 3,350 | **.001** |
| at work | 0.88 (0.47, 1.29) | **>.0001** | 0.78 | 0.93 (0.47, 1.38) | **.0001** | 0.82 | 0.46 (0.01, 0.91) | **.049** | 0.41 | 7.73 | 3,350 | **<.0001** |
| at home | 0.34 (-0.03, 0.71) | .071 | 0.33 | 0.33 (-0.06, 0.73) | .099 | 0.32 | -0.03 (-0.45, 0.39) | .903 | -0.03 | 2.11 | 3,350 | .099 |
| when outside of home | 0.28 (0.11, 0.67) | .170 | 0.26 | 0.24 (-0.18, 0.65) | .264 | 0.22 | 0.22 (-0.19, 0.62) | .293 | 0.21 | 0.77 | 3,350 | .513 |
| when alone | 0.43 (0.05, 0.81) | **.028** | 0.40 | 0.44 (0.01, 0.86) | **.046** | 0.41 | -0.08 (-0.51, 0.35) | .715 | -0.07 | 3.56 | 3,350 | **.019** |
| when quiet | 0.26 (-0.13, 0.64) | .195 | 0.23 | 0.1 (-0.32, 0.53) | .638 | 0.09 | -0.22 (-0.64, 0.21) | .317 | -0.20 | 1.66 | 3,350 | .175 |
| when moving | 0.08 (-0.34, 0.5) | .712 | 0.07 | -0.13 (-0.57, 0.32) | .576 | -0.10 | -0.16 (-0.59, 0.28) | .480 | -0.13 | 0.45 | 3,350 | .714 |

Supplementary Figure 3

*Distribution of resident physicians' ratings of whether they had achieved their goals at t1*




*Note:* A score of 0 indicates that the formulated goal was *achieved as expected*, -2 *much less than expected* and 2 *much more than expected*.

**References**

Heger, B. (2015). *Muße als psychologisches Konstrukt. Eine theoretische und empirische Annäherung [Muße as a psychological construct. A theoretical and empirical investigation] (Unpublished master's thesis)*. University of Freiburg, Germany.

Johnson, R. E., Tolentino, A. L., Rodopman, O. B., & Cho, E. (2010). We (sometimes) know not how we feel: Predicting job performance with an implicit measure of trait affectivity. *Personnel Psychology*, *63*(1), 197–219. https://doi.org/10.1111/j.1744-6570.2009.01166.x

Karpinski, A., & Steinman, R. B. (2006). The Single Category Implicit Association Test as a measure of implicit social cognition. *Journal of Personality and Social Psychology*, *91*(1), 16–32. https://doi.org/10.1037/0022-3514.91.1.16

Koopman, J., Howe, M., Johnson, R. E., Tan, J. A., & Chang, C.-H. (2013). A framework for developing word fragment completion tasks. *Human Resource Management Review*, *23*(3), 242–253. https://doi.org/10.1016/j.hrmr.2012.12.005

Payne, B. K., Cheng, C. M., Govorun, O., & Stewart, B. D. (2005). An inkblot for attitudes: Affect misattribution as implicit measurement. *Journal of Personality and Social Psychology*, *89*(3), 277–293. https://doi.org/10.1037/0022-3514.89.3.277

Richard, A., Meule, A., Friese, M., & Blechert, J. (2017). Effects of chocolate deprivation on implicit and explicit evaluation of chocolate in high and low trait chocolate cravers. *Frontiers in Psychology*, *8*, 1591. https://doi.org/10.3389/fpsyg.2017.01591