## **Supplemental material**

Table S1: Handling of Missing Item Values in the Primary Outcome and in Score Calculations

Table S2: Intervention effect of sleep-related secondary outcomes, missing values imputed by LOCF

Table S3: Cost data on the expenses for the intervention implementation for all intervention clusters

This supplementary material has been provided by the authors to give readers additional

information about their work

## **Table S1: Handling of Missing Item Values in the Primary Outcome and in Score Calculations**

|  |  |
| --- | --- |
| **Variable / Score** | **Umgang mit Missings** |
| Primary outcome: ≥ 2 sleep problems Sleep Disorder Inventory (SDI) | If ≥2 items ="yes", then primary outcome = "yes", other missings not considered;  |
|  | If 1 item ="yes" and no other item is missing, then primary outcome = "no";  |
|  | If no item ="yes" and a maximum of one other missing item then, primary outcome = "no";  |
|   | Otherwise primary outcome missing |
| Sleep Disorder Inventory (SDI) score | Calculation of the score as sum of products of (frequency item) \* (severity item) [Hjetland];  |
|  | A maximum of one missing product value of frequency and severity is imputed by the mean of the other product values;  |
|   | In case of more than one missing product values the score value is missing |
| Essener Questionnaire of Age and Sleepiness in the Elderly (EFAS) | No imputation of missings;  |
| Pittsburgh Sleep Quality Index (PSQI) | Only component 5j (other sleep disturbance) is imputed by 0="no", if no other missings in sleep disturbances in component 5;  |
|   | No other imputations |
| Cohen Mansfield Agitation Inventory (CMAI) | A maximum of one missing item is imputed by the mean of the other items;  |
|   | In case of more than one missing item the score value is missing |
| QUALIDEM | For each subscale a maximum of one missing item is imputed by the mean of the other items of the subscale;  |
|  | In case of more than one missing item in one subscale the scubscale value is missing;  |
|  | The total sum score of the 6 subscale is calculated only if there are no missing values for all 6 subscales;  |
|  | Otherwise the total sum score is missing |

## **Table S2: Intervention effect of sleep-related secondary outcomes, missing values imputed by LOCF**

|  |  |  |  |
| --- | --- | --- | --- |
| **Prevalence ≥ 2 sleep problems SDI** | **T0** | **T1** | **T2** |
|  |  | **Intervention group****N = 124** | **Control group****N = 112** | **Intervention group****N = 126** | **Control group****N = 116** | **Intervention group****N = 126** | **Control group****N = 116** |
|  | Prevalence % [95% CI] | 89.5 [82.5-96.5] | 92.9 [87.4-98.3] | 69.0 [55.9-82.2] | 81.9 [73.6-90.2] | 67.5 [52.7-82.2] | 81.9 [70.6-93.2] |
|  | ICCC | 0.0579 | 0.0281 | 0.144 | 0.0359 | 0.1974 | 0.1568 |
|  | Odds Ratio IG/CG [95% CI] Model adjusted for T0-value |  |  | 0.404 [0.130-1.360] p = 0.137 | 0.369 [0.114-1.198] p = 0.093 |
|  | Model-based group test overall (T1, T2) | pg = 0.099 |
| **Sleep Disorders Inventory Score (0-84)** |  |  |  |  |  |
|  |  | **Intervention group****N = 124** | **Control group****N = 106** | **Intervention group****N = 125** | **Control group****N = 115** | **Intervention group****N = 125** | **Control group****N = 115** |
|  | Mean [95% CI] | 19.3 [15.8 – 22.7] | 22.3 [17.3 – 27.4] | 10.9 [7.5 – 14.3] | 19.0 [14.6 – 23.4] | 10.8 [7.6 – 14.0] | 21.3 [14.6 – 28.1] |
|  | ICCC | 0.0947 | 0.1655 | 0.1508 | 0.0997 | 0.1083 | 0.2236 |
|  | Difference IG - CG [95% CI] Model adjusted for T0-value |  |  | -6.4 [-10.1 - -2.7] p = 0.0018 | -9.0 [-13.1 - -4.9] p < 0.0001 |
|  | Model-based group test overall (T1, T2) | pg = 0.0001 |
| **Essener Questionnaire of Age and Sleepiness in the Elderly Score (0-48)** |  |  |  |  |
|  |  | **Intervention group****N = 122** | **Control group****N = 105** | **Intervention group** | **Control group** | **Intervention group****N = 125** | **Control group****N = 113** |
|  | Mean [95% CI] | 3.1 [2.1 – 4.1] | 4.1 [2.8 – 5.3] | --- | --- | 2.8 [2.1 – 3.5] | 4.2 [3.0 – 5.4] |
|  | ICCC | 0.1943 | 0.1933 | --- | --- | 0.0426 | 0.1676 |
|  | Difference IG - CG [95% CI] Model adjusted for T0-value |  |  |  |  | -0.8 [-1.7 - 0.1] p = 0.0939 |
| **Pittsburgh Sleep Quality Index (0-21)** |  |  |  |  |
|  |  | **Intervention group****N = 20** | **Control group****N = 23** | **Intervention group** | **Control group** | **Intervention group****N = 35** | **Control group****N = 37** |
|  | Mean [95% CI] | 4.2 [2.7 – 5.6] | 4.2 [2.1 – 6.2] | --- | --- | 4.7 [3.5 – 5.9] | 4.3 [3.3 – 5.3] |
|  | ICCC | 0 | 0.2975 | --- | --- | 0.0527 | 0 |
|  | Difference IG - CG [95% CI] Model adjusted for T0-value |  |  |  |  | 0.1 [-1.1 - 1.3]p = 0.8794 |

IG =Intervention Group; ICCC = Intra-class Correlation Coefficient; CG = Control Group; 95% CI = 95% cluster-adjusted (Donner and Klar, 2000) confidence interval.

## **Table S3: Cost data on the expenses for the intervention implementation for all intervention clusters**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Item of resource** | **Unit** | **Unit used** | **Cost per unit (€/$)** | **Total Cost (€/$)** | **Source of Information** |
| **Component 1: Assessment of established sleep-promoting interventions and environmental aspects in the participating nursing homes** |
|  | Research associate salary | Hour | 112 | 25.78/27.42 | 2,887.36/3,071.28 | Protocols with documented time spent |
|  | Research assistant salary | Hour | 40 | 12.37/13.16 | 494.80/526.17 | Protocols with documented time spent |
|  | Registered nurse salary | Hour | 12 | 17.84/18.98 | 214.08/227.65 | Protocols with documented time spent |
| **Component 2: Training and implementation of two sleep nurses as change agents per nursing home** |
|  | Research associate salary | Hour | 19 | 25.78/27.42 | 489.82/520.87 | Protocols with documented time spent |
|  | Research assistant salary | Hour | 10 | 12.37/13.16 | 123.70/131.54 | Protocols with documented time spent |
|  | Registered nurse salary | Hour | 36 | 17.84/18.98 | 642.24/682.96 | Protocols with documented time spent |
| **Component 3: Basic education courses for nursing staff: “Sleep problems in dementia”** |
|  | Research associate salary | Hour | 22 | 25.78/27.42 | 567.16/603.12 | Protocols with documented time spent |
|  | Research assistant salary | Hour | 12 | 12.37/13.16 | 148.44/157.85 | Protocols with documented time spent |
|  | Registered nurse salary | Hour | 134 | 17.84/18,98 | 2,390.56/2,542.12 | Protocols with documented time spent |
|  | Assistant nurse salary | Hour | 33 | 16.05/17.07 | 529.65/563.23 | Protocols with documented time spent |
| **Component 4: Advanced education courses for nursing staff: “Tailored problem-soling” (two workshops)** |
|  | Research associate salary | Hour | 40 | 25.78/27.42 | 1,031.20/1,096.58 | Protocols with documented time spent |
|  | Research assistant salary | Hour | 21 | 12.37/13.16 | 259.77/276.24 | Protocols with documented time spent |
|  | Registered nurse salary | Hour | 122 | 17.84/18,98 | 2,176.48/2,314.47 | Protocols with documented time spent |
|  | Assistant nurse salary | Hour | 31 | 16.05/17.07 | 497.55/529.09 | Protocols with documented time spent |
| **Component 5: Two workshops with nursing management and sleep nurses: “Development of an institutional sleep-promoting concept”** |
|  | Research associate salary | Hour | 43 | 25.78/27.42 | 1108.54/1,178.82 | Protocols with documented time spent |
|  | Research assistant salary | Hour | 22 | 12.37/13.16 | 272.14/289.39 | Protocols with documented time spent |
|  | Registered nurse salary | Hour | 144 | 17.84/18,98 | 2,568.96/2,731.83 | Protocols with documented time spent |
|  | Assistant nurse salary | Hour | 28 | 16.05/17.07 | 449.40/477.89 | Protocols with documented time spent |
| **Component 6: Written information and education material** |
|  | Brochures | Item | 490 | 0.80/0.85 | 392.00/416.85 | Invoice by manufacturer |
|  | One Minute Wonder poster set | 1 Set = 8 Poster | 127 | 6.40/6.81 | 812.80/864.33 | Invoice by manufacturer |
|  | Education material | --- | --- | --- | 380.00/404.09 | Invoice by manufacturer |
| **Total costs** |  |  |  | **18,436.65/19,605.53** |  |