# Statistical Analyses Outputs

## 1. RQ1: Frequency of MRE-Containing Observations

### 1.1. A sample model fitting and results with one of the imputed datasets

```
lme <- glmer(MREO ~ (ST + POWL + PONM)^2 + (1|Site) + (1|Subject), family = "binomial", data = subset(data.imp, Set == 1))

# Variables:
#       MREO: MRE occrrence. Binary variable.
#       ST: Shift type – day shift or night shift.
#       POWL: Pre-observation workload.
#       PONM: Pre-observation negative mood.
#       Site: Three data collection sites (ICUs). Random variable.
#       Subject: Nurse participants. Random variable.
# Input data: The first (Set == 1) of the thirty-five imputed datasets (data.imp).
```

```
Generalized linear mixed model fit by maximum likelihood (Laplace Approximation) ['glmerMod']
 Family: binomial  ( logit )
Formula: MREO ~ (ST + POWL + PONM)^2 + (1 | Site) + (1 | Subject)
   Data: subset(data.imp, Set == 1)

     AIC      BIC   logLik deviance df.resid
   157.3    182.6    -69.6    139.3      115

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.1115 -0.7177 -0.4047  0.8668  2.8325

Random effects:
 Groups  Name        Variance  Std.Dev.
 Subject (Intercept) 1.716e-08 0.000131
 Site    (Intercept) 7.733e-04 0.027809
Number of obs: 124, groups:  Subject, 86; Site, 3
```

```
Fixed effects:
                    Estimate Std. Error z value Pr(>|z|)
(Intercept)        -0.6465540  0.2436102  -2.654 0.007953 **
STNight_v_Day      -0.8410575  0.7896462  -1.065 0.286828
POWL                0.1181889  0.0339295   3.483 0.000495 ***
PONM               -0.0019074  0.0165854  -0.115 0.908440
STNight_v_Day:POWL -0.1249362  0.0671429  -1.861 0.062779 .
STNight_v_Day:PONM -0.1125081  0.0753142  -1.494 0.135215
POWL:PONM          -0.0008303  0.0020887  -0.398 0.690982
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) STNg__D POWL   PONM   STN__D:POW STN__D:PON
STNght_v_Dy -0.288
POWL        -0.245  0.104
PONM        -0.084  0.024   0.061
STN__D:POWL  0.158 -0.225  -0.516 -0.010
STN__D:PONM  0.032  0.722   0.005 -0.221 -0.094
POWL:PONM    0.056 -0.054  -0.152  0.087  0.302      -0.037
```

## 1.2. Results from the same model fittings for the 35 imputed datasets combined with Rubin’s rule

The following table presents results when ST was dummy coded with day shift as the reference level.

| | Variable | Q | Adj. OR | W | B | T | df | t | 95% CI (Adj. OR) | p |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | (Intercept) | -0.662 | 0.516 | 0.074 | 0.002 | 0.076 | 117.982 | -2.399 | [0.299, 0.890] | 0.018 * |
| 2 | STNight_v_Day | -0.795 | 0.452 | 0.576 | 0.017 | 0.593 | 118.176 | -1.032 | [0.098, 2.075] | 0.304 |
| 3 | POWL | 0.122 | 1.130 | 0.001 | 0.001 | 0.002 | 70.982 | 2.827 | [1.037, 1.231] | 0.006 ** |
| 4 | PONM | 0.008 | 1.008 | <0.001 | <0.001 | 0.001 | 47.455 | 0.295 | [0.954, 1.065] | 0.770 |
| 5 | STNight_v_Day:POWL | -0.116 | 0.890 | 0.005 | 0.001 | 0.005 | 105.857 | -1.605 | [0.772, 1.027] | 0.112 |
| 6 | STNight_v_Day:PONM | -0.128 | 0.880 | 0.006 | <0.001 | 0.006 | 110.328 | -1.599 | [0.751, 1.031] | 0.113 |
| 7 | POWL:PONM | 0.001 | 1.001 | <0.001 | <0.001 | <0.001 | 32.344 | 0.391 | [0.994, 1.009] | 0.698 |

Note. Q: average of the point estimates. Adj. OR: adjusted odds ratio. W: within-imputation variance. B: between-imputation variance. T: total variance. df: degrees of freedom. CI: confidence interval.

The following table presents results when ST was effects coded with weights -0.5 (day shift) and 0.5 (night shift).

| | Variable | Q | Adj. OR | W | B | T | df | t | 95% CI (Adj. OR) | p |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | (Intercept) | -1.059 | 0.347 | 0.163 | 0.003 | 0.166 | 119.405 | -2.596 | [0.155, 0.778] | 0.011 * |
| 2 | STNight_v_Day | -0.795 | 0.452 | 0.576 | 0.017 | 0.593 | 118.177 | -1.032 | [0.098, 2.075] | 0.304 |
| 3 | POWL | 0.064 | 1.066 | 0.001 | <0.001 | 0.002 | 89.428 | 1.640 | [0.986, 1.153] | 0.105 |
| 4 | PONM | -0.056 | 0.946 | 0.001 | <0.001 | 0.002 | 115.749 | -1.423 | [0.875, 1.022] | 0.158 |
| 5 | STNight_v_Day:POWL | -0.116 | 0.890 | 0.005 | 0.001 | 0.005 | 105.856 | -1.605 | [0.772, 1.027] | 0.112 |
| 6 | STNight_v_Day:PONM | -0.128 | 0.880 | 0.006 | <0.001 | 0.006 | 110.325 | -1.599 | [0.751, 1.031] | 0.113 |
| 7 | POWL:PONM | 0.001 | 1.001 | <0.001 | <0.001 | <0.001 | 32.344 | 0.391 | [0.994, 1.009] | 0.698 |

Note. Q: average of the point estimates. Adj. OR: adjusted odds ratio. W: within-imputation variance. B: between-imputation variance. T: total variance. df: degrees of freedom. CI: confidence interval.

## 2. RQ3: Nurses' Activities and Their Correlations with MREs

### 2.1. Total task volume (TTV) predicted by shift type, pre-observation workload, and pre-observation negative mood

#### 2.1.1. A sample model fitting and results with one of the imputed datasets

```
lme <- lmer(TTV ~ (ST + POWL + PONM)^2 + (1|Site) + (1|Subject), data = subset(data.imp, Set == 1))


# Variables:
#       TTV: Total task volome.
#       ST: Shift type – day shift or night shift.
#       POWL: Pre-observation workload.
#       PONM: Pre-observation negative mood.
#       Site: Three data collection sites (ICUs). Random variable.
#       Subject: Nurse participants. Random variable.
# Input data: The first (Set == 1) of the thirty-five imputed datasets (data.imp).


Linear mixed model fit by REML
t-tests use  Satterthwaite approximations to degrees of freedom ['lmerMod']
Formula: TTV ~ (ST + POWL + PONM)^2 + (1 | Site) + (1 | Subject)
   Data: subset(data.imp, Set == 1)

REML criterion at convergence: 1208.9

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.94922 -0.58015 -0.03582  0.51805  2.99957

Random effects:
 Groups   Name        Variance Std.Dev.
 Subject  (Intercept) 186.2    13.65
 Site     (Intercept)   0.0     0.00
 Residual             933.1    30.55
Number of obs: 124, groups:  Subject, 86; Site, 3
```

```
Fixed effects:
                    Estimate Std. Error         df t value Pr(>|t|)
(Intercept)         -4.39779    3.58756  75.34000  -1.226  0.22408
STNight_v_Day       18.14897    8.05934  90.45000   2.252  0.02675 *
POWL                 1.01661    0.37653 105.24000   2.700  0.00808 **
PONM                -0.02190    0.25406 116.65000  -0.086  0.93145
STNight_v_Day:POWL   0.70823    0.93641  98.85000   0.756  0.45125
STNight_v_Day:PONM  -0.04896    0.60493 112.30000  -0.081  0.93564
POWL:PONM            0.03856    0.02155 116.92000   1.789  0.07615 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) STNg__D POWL   PONM   STN__D:POW STN__D:PON
STNght_v_Dy -0.440
POWL         0.005  0.002
PONM        -0.027 -0.005  -0.001
STN__D:POWL  0.001 -0.221  -0.422  0.046
STN__D:PONM  0.006  0.180   0.013 -0.445 -0.049
POWL:PONM    0.008 -0.042  -0.150  0.373  0.186      -0.229
```

### 2.1.2. Results from the same model fittings for the 35 imputed datasets combined with Rubin’s rule

The following table presents results when ST was dummy coded with day shift as the reference level.

| | Variable | Q | W | B | T | df | t | 95% CI | p |
|---|---|---|---|---|---|---|---|---|---|
| 1 | (Intercept) | -4.772 | 13.439 | 0.526 | 13.980 | 116.716 | -1.276 | [-12.178, 2.633] | 0.204 |
| 2 | STNight_v_Day | 18.942 | 65.615 | 1.429 | 67.085 | 119.173 | 2.313 | [ 2.724, 35.160] | 0.022 * |
| 3 | POWL | 1.039 | 0.140 | 0.037 | 0.178 | 85.404 | 2.464 | [ 0.201, 1.877] | 0.016 * |
| 4 | PONM | -0.101 | 0.083 | 0.031 | 0.114 | 73.443 | -0.298 | [-0.774, 0.573] | 0.767 |
| 5 | STNight_v_Day:POWL | 0.621 | 0.877 | 0.032 | 0.910 | 117.107 | 0.651 | [-1.269, 2.510] | 0.517 |
| 6 | STNight_v_Day:PONM | 0.041 | 0.390 | 0.044 | 0.435 | 105.658 | 0.062 | [-1.266, 1.348] | 0.951 |
| 7 | POWL:PONM | 0.033 | <0.001 | 0.001 | 0.001 | 28.053 | 0.902 | [-0.042, 0.109] | 0.375 |

Note. Q: average of the point estimates. W: within-imputation variance. B: between-imputation variance. T: total variance. df: degrees of freedom. CI: confidence interval.

The following table presents results when ST was effects coded with weights -0.5 (day shift) and 0.5 (night shift).

| | Variable | Q | W | B | T | df | t | 95% CI | p |
|---|---|---|---|---|---|---|---|---|---|
| 1 | (Intercept) | 4.439 | 16.534 | 2.833 | 19.448 | 97.105 | 1.007 | [-4.313, 13.192] | 0.317 |
| 2 | ST | 18.942 | 65.615 | 1.429 | 67.085 | 119.173 | 2.313 | [ 2.724, 35.160] | 0.022 * |
| 3 | POWL | 1.339 | 0.215 | 0.021 | 0.237 | 107.753 | 2.750 | [ 0.374, 2.304] | 0.007 ** |
| 4 | PONM | -0.080 | 0.092 | 0.007 | 0.099 | 112.030 | -0.253 | [-0.703, 0.544] | 0.801 |
| 5 | ST:POWL | 0.621 | 0.877 | 0.032 | 0.910 | 117.107 | 0.651 | [-1.269, 2.510] | 0.517 |
| 6 | ST:PONM | 0.041 | 0.390 | 0.044 | 0.435 | 105.658 | 0.062 | [-1.266, 1.348] | 0.951 |
| 7 | POWL:PONM | 0.033 | <0.001 | 0.001 | 0.001 | 28.053 | 0.902 | [-0.042, 0.109] | 0.375 |

Note. Q: average of the point estimates. W: within-imputation variance. B: between-imputation variance. T: total variance. df: degrees of freedom. CI: confidence interval.

## 2.2. The correlation between TTV and MRE controling other variables

### 2.2.1. A sample model fitting and results with one of the imputed datasets

```
lme <- lmer(TTV ~ (MREO + ST + POWL + PONM)^2 + (1|Site) + (1|Subject), data = subset(data.imp, Set == 1))

# Variables:
#       TTV: Total task volome.
#       MREO: MRE occrrence. Binary variable.
#       ST: Shift type – day shift or night shift.
#       POWL: Pre-observation workload.
#       PONM: Pre-observation negative mood.
#       Site: Three data collection sites (ICUs). Random variable.
#       Subject: Nurse participants. Random variable.
# Input data: The first (Set == 1) of the thirty-five imputed datasets (data.imp).

Linear mixed model fit by REML
t-tests use  Satterthwaite approximations to degrees of freedom ['lmerMod']
Formula: TTV ~ (MREO + ST + POWL + PONM)^2 + (1 | Site) + (1 | Subject)
   Data: subset(data.imp, Set == 1)

REML criterion at convergence: 1184.6

Scaled residuals:
    Min      1Q  Median      3Q     Max
-1.9528 -0.5061 -0.1019  0.4620  3.0137

Random effects:
 Groups   Name        Variance Std.Dev.
 Subject  (Intercept) 255.8    15.99
 Site     (Intercept)   0.0     0.00
 Residual             827.5    28.77
Number of obs: 124, groups:  Subject, 86; Site, 3

Fixed effects:
                  Estimate Std. Error        df t value Pr(>|t|)
(Intercept)        -1.44496    4.71445  96.95000  -0.306  0.75988
MREOyes_v_no       25.30941    8.58323 111.68000   2.949  0.00389 **
ST                  6.81029    9.45204  97.94000   0.721  0.47293
POWL                1.54729    0.50054 100.96000   3.091  0.00258 **
```

```
PONM                 0.16183    0.31781 110.20000   0.509  0.61163
MREOyes_v_no:ST     42.23261   17.30716 112.87000   2.440  0.01624 *
MREOyes_v_no:POWL   -0.63496    0.84220 105.68000  -0.754  0.45257
MREOyes_v_no:PONM    0.38812    0.52790  96.76000   0.735  0.46398
ST:POWL              0.79887    0.94208 100.23000   0.848  0.39847
ST:PONM              0.55652    0.63206 106.96000   0.880  0.38057
POWL:PONM            0.03079    0.02189 112.47000   1.406  0.16246
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) MREOy__ ST     POWL   PONM   MREO__:S MREO__:POW MREO__:PON ST:POW ST:PON
MREOyes_v_n -0.478
ST           0.532 -0.268
POWL        -0.136  0.029 -0.259
PONM        -0.013  0.189  0.017  0.006
MREOys__:ST -0.229  0.606 -0.494  0.051  0.176
MREO__:POWL -0.020 -0.167  0.077 -0.384  0.040  0.095
MREO__:PONM  0.022  0.241 -0.034 -0.011 -0.258  0.310    0.028
ST:POWL     -0.250  0.098 -0.158  0.586  0.019 -0.047   -0.012     -0.027
ST:PONM      0.017  0.285 -0.001 -0.017  0.614  0.308    0.021      0.138     -0.025
POWL:PONM   -0.047 -0.048 -0.009  0.021  0.144 -0.093    0.044     -0.266      0.191 -0.241
```

### 2.2.2. Results from the same model fittings for the 35 imputed datasets combined with Rubin’s rule

The following table presents results when MREO was dummy coded with absense of MRE as the reference level.

| | Variable | Q | W | B | T | df | t | 95% CI | p |
|---|---|---|---|---|---|---|---|---|---|
| 1 | (Intercept) | -1.493 | 22.853 | 0.533 | 23.401 | 118.961 | -0.309 | [-11.072, 8.086] | 0.758 |
| 2 | MREOyes_v_no | 24.270 | 76.210 | 4.082 | 80.409 | 114.611 | 2.707 | [ 6.507, 42.033] | 0.008 ** |
| 3 | ST | 6.533 | 92.025 | 4.239 | 96.385 | 115.715 | 0.665 | [-12.913, 25.978] | 0.507 |
| 4 | POWL | 1.583 | 0.262 | 0.039 | 0.302 | 100.147 | 2.880 | [ 0.493, 2.674] | 0.005 ** |
| 5 | PONM | 0.169 | 0.112 | 0.009 | 0.121 | 110.933 | 0.488 | [-0.519, 0.858] | 0.627 |
| 6 | MREOyes_v_no:ST | 41.900 | 299.590 | 5.503 | 305.250 | 119.639 | 2.398 | [ 7.307, 76.493] | 0.018 * |
| 7 | MREOyes_v_no:POWL | -0.714 | 0.669 | 0.079 | 0.750 | 105.000 | -0.825 | [-2.432, 1.003] | 0.411 |
| 8 | MREOyes_v_no:PONM | 0.198 | 0.367 | 0.076 | 0.446 | 92.125 | 0.297 | [-1.128, 1.524] | 0.767 |
| 9 | ST:POWL | 0.686 | 0.888 | 0.043 | 0.932 | 115.327 | 0.710 | [-1.227, 2.598] | 0.479 |
| 10 | ST:PONM | 0.600 | 0.441 | 0.063 | 0.506 | 101.134 | 0.843 | [-0.812, 2.011] | 0.401 |
| 11 | POWL:PONM | 0.030 | 0.001 | 0.001 | 0.002 | 26.046 | 0.734 | [-0.055, 0.115] | 0.469 |

Note. Q: average of the point estimates. W: within-imputation variance. B: between-imputation variance. T: total variance. df: degrees of freedom. CI: confidence interval.

The following table presents results when MREO was effects coded with weights -0.5 (absense of MRE) and 0.5 (presence of MRE).

| | Variable | Q | W | B | T | df | t | 95% CI | p |
|---|---|---|---|---|---|---|---|---|---|
| 1 | (Intercept) | 10.642 | 21.573 | 1.715 | 23.337 | 110.726 | 2.203 | [ 1.069, 20.215] | 0.030 |
| 2 | MREO | 24.270 | 76.210 | 4.082 | 80.409 | 114.611 | 2.707 | [ 6.507, 42.033] | 0.008 ** |
| 3 | ST | 27.483 | 83.843 | 4.887 | 88.870 | 113.910 | 2.915 | [ 8.807, 46.158] | 0.004 ** |
| 4 | POWL | 1.226 | 0.263 | 0.021 | 0.285 | 110.581 | 2.298 | [ 0.169, 2.284] | 0.023 * |
| 5 | PONM | 0.268 | 0.140 | 0.012 | 0.151 | 110.284 | 0.690 | [-0.503, 1.040] | 0.492 |
| 6 | MREO:ST | 41.900 | 299.590 | 5.503 | 305.250 | 119.639 | 2.398 | [ 7.307, 76.493] | 0.018 * |
| 7 | MREO:POWL | -0.714 | 0.669 | 0.079 | 0.750 | 105.000 | -0.825 | [-2.432, 1.003] | 0.411 |
| 8 | MREO:PONM | 0.198 | 0.367 | 0.076 | 0.446 | 92.125 | 0.297 | [-1.128, 1.524] | 0.767 |
| 9 | ST:POWL | 0.686 | 0.888 | 0.043 | 0.932 | 115.327 | 0.710 | [-1.227, 2.598] | 0.479 |
| 10 | ST:PONM | 0.600 | 0.441 | 0.063 | 0.506 | 101.134 | 0.843 | [-0.812, 2.011] | 0.401 |
| 11 | POWL:PONM | 0.030 | 0.001 | 0.001 | 0.002 | 26.046 | 0.734 | [-0.055, 0.115] | 0.469 |

Note. Q: average of the point estimates. W: within-imputation variance. B: between-imputation variance. T: total variance. df: degrees of freedom. CI: confidence interval.

## 2.3. The correlations between Task volume (TV) of the task categories and MRE controling other variables

### 2.3.1. A sample model fitting and results with one of the imputed datasets

lme <- lmer( TV_Medication ~ (MRE + ShiftType + Mood_Score_Pre + NASATLX_Score_Pre)^2 + (1|Site) + (1|Subject), data = subset(data.imp, Set == 1))

```
# Variables:
#       TV_Medication: Task volome of medication tasks.
#       MREO: MRE occrrence. Binary variable.
#       ST: Shift type – day shift or night shift.
#       POWL: Pre-observation workload.
#       PONM: Pre-observation negative mood.
#       Site: Three data collection sites (ICUs). Random variable.
#       Subject: Nurse participants. Random variable.
# Input data: The first (Set == 1) of the thirty-five imputed datasets (data.imp).

Linear mixed model fit by REML
t-tests use  Satterthwaite approximations to degrees of freedom ['lmerMod']
Formula: TV_Medication ~ (MREO + ST + POWL + PONM)^2 + (1 | Site) + (1 |      Subject)
   Data: subset(data.imp, Set == 1)

REML criterion at convergence: 855.7

Scaled residuals:
     Min       1Q   Median       3Q      Max
-1.74862 -0.54370 -0.05778  0.53125  2.91469

Random effects:
 Groups   Name        Variance Std.Dev.
 Subject  (Intercept) 12.14    3.484
 Site     (Intercept) 13.96    3.737
 Residual             44.51    6.671
Number of obs: 124, groups:  Subject, 86; Site, 3

Fixed effects:
             Estimate Std. Error         df t value Pr(>|t|)
(Intercept)   1.210319   2.444691   2.230000   0.495   0.6650
MREO          3.801898   1.994063 109.780000   1.907   0.0592 .
ST            5.208564   2.128788  96.200000   2.447   0.0162 *
```

```
POWL          0.256495   0.119194 109.550000   2.152   0.0336 *
PONM         -0.022775   0.083014 106.100000  -0.274   0.7843
MREO:ST       8.928208   3.982813 110.680000   2.242   0.0270 *
MREO:POWL    -0.227056   0.193861 103.690000  -1.171   0.2442
MREO:PONM     0.075862   0.121698  93.390000   0.623   0.5346
ST:POWL       0.144787   0.216208  94.660000   0.670   0.5047
ST:PONM       0.267351   0.147064 103.870000   1.818   0.0720 .
POWL:PONM    -0.002179   0.005080 111.210000  -0.429   0.6689
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
          (Intr) MREO   ST     POWL   PONM   MREO:S MREO:POW MREO:PON ST:POW ST:PON
MREO       0.200
ST         0.297  0.308
POWL      -0.116 -0.092 -0.072
PONM       0.147  0.364  0.363  0.059
MREO:ST    0.140  0.608  0.431  0.137  0.393
MREO:POWL -0.070 -0.173  0.170  0.434  0.045  0.086
MREO:PONM  0.117  0.243  0.267  0.011  0.508  0.307  0.028
ST:POWL   -0.057  0.089 -0.193  0.535 -0.017 -0.057 -0.006   -0.026
ST:PONM    0.130  0.305  0.302  0.018  0.659  0.317  0.011    0.143   -0.039
POWL:PONM -0.047 -0.071 -0.111  0.041 -0.093 -0.104  0.049   -0.267    0.197 -0.263
```

### 2.3.2. Results from the same model fittings for the 35 imputed datasets combined with Rubin’s rule

The following table only presents the effects of MRE on TVs of the 12 task categories. These effects were tested in separate models similar to the one presented in 2.3.1.

| Task Categories | Q | W | B | T | df | t | 95% CI | p |
|---|---|---|---|---|---|---|---|---|
| TV_Medication | 3.507 | 4.171 | 0.475 | 4.659 | 105.512 | 1.625 | [-0.773, 7.787] | 0.107 |
| TV_Direct_Patient_Care | 10.817 | 13.564 | 0.511 | 14.090 | 116.927 | 2.882 | [ 3.383, 18.251] | 0.005 ** |
| TV_Documentation_Review | 2.566 | 1.596 | 0.049 | 1.646 | 117.904 | 2.000 | [ 0.025, 5.106] | 0.048 * |
| TV_Administration | -0.051 | 0.049 | 0.001 | 0.050 | 120.143 | -0.227 | [-0.493, 0.391] | 0.821 |
| TV_Observation | 1.343 | 3.545 | 0.288 | 3.841 | 110.474 | 0.685 | [-2.541, 5.226] | 0.495 |
| TV_Conversational | 5.014 | 13.572 | 0.797 | 14.393 | 113.84 | 1.322 | [-2.501, 12.53] | 0.189 |
| TV_Assistance | 0.232 | 0.059 | 0.003 | 0.062 | 115.91 | 0.937 | [-0.259, 0.724] | 0.351 |
| TV_Teaching_Learning | -0.394 | 0.207 | 0.010 | 0.217 | 115.699 | -0.846 | [-1.318, 0.529] | 0.399 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| TV_Housekeeping | 0.609 | 0.152 | 0.002 | 0.154 | 120.361 | 1.552 | [-0.168, 1.386] | 0.123 |
| TV_Transportation | 0.099 | 0.014 | 0.002 | 0.016 | 105.648 | 0.782 | [-0.153, 0.351] | 0.436 |
| TV_Personal | -0.035 | 0.095 | 0.004 | 0.099 | 115.584 | -0.111 | [-0.660, 0.59] | 0.912 |
| TV_Miscellaneous | 0.970 | 0.460 | 0.030 | 0.491 | 112.912 | 1.384 | [-0.419, 2.359] | 0.169 |

Note. Q: average of the point estimates. W: within-imputation variance. B: between-imputation variance. T: total variance. df: degrees of freedom. CI: confidence interval.

The following table presents the effects of MRE on TVs of the individual tasks within medication tasks category.

| Medication Tasks | Q | W | B | T | df | t | 95% CI | p |
|---|---|---|---|---|---|---|---|---|
| TV_Medication_Documentation_Review | 1.099 | 0.286 | 0.008 | 0.293 | 118.534 | 2.029 | [ 0.027, 2.172] | 0.045 * |
| TV_Prep_Admin_Medications | 0.206 | 0.248 | 0.012 | 0.260 | 115.527 | 0.403 | [-0.804, 1.216] | 0.687 |
| TV_IV_Fluid_Management | 0.782 | 0.468 | 0.068 | 0.538 | 100.775 | 1.066 | [-0.673, 2.237] | 0.289 |
| TV_Obtain_Confirm_Medications | 0.820 | 0.081 | 0.003 | 0.084 | 117.794 | 2.835 | [ 0.247, 1.393] | 0.005 ** |
| TV_Infusion_Pumps | 0.464 | 0.461 | 0.016 | 0.477 | 117.369 | 0.671 | [-0.904, 1.832] | 0.503 |
| TV_IV_Medications | -0.032 | 0.187 | 0.009 | 0.196 | 115.675 | -0.072 | [-0.909, 0.845] | 0.943 |

Note. Q: average of the point estimates. W: within-imputation variance. B: between-imputation variance. T: total variance. df: degrees of freedom. CI: confidence interval.

## 2.4. Percentage of time (PT) spent on tasks

A sample model fitting is not presented in this section as the models were similar to the one presented in 2.3.1. The following table only presents the effects of MRE on PTs of the 12 task categories. These effects were tested in separate models similar to the one presented in 2.3.1.

| Task Categories | Q | W | B | T | df | t | 95% CI | p |
|---|---|---|---|---|---|---|---|---|
| PT_Medication | 0.019 | <0.001 | <0.001 | <0.001 | 107.040 | 1.350 | [-0.009, 0.047] | 0.180 |
| PT_Direct_Patient_Care | 0.044 | <0.001 | <0.001 | <0.001 | 118.318 | 2.095 | [ 0.002, 0.086] | 0.038 * |
| PT_Documentation_Review | -0.003 | <0.001 | <0.001 | <0.001 | 117.679 | -0.147 | [-0.038, 0.033] | 0.884 |
| PT_Administration | -0.003 | <0.001 | <0.001 | <0.001 | 119.581 | -1.068 | [-0.008, 0.002] | 0.288 |
| PT_Observation | -0.005 | <0.001 | <0.001 | <0.001 | 103.456 | -0.524 | [-0.026, 0.015] | 0.601 |
| PT_Conversational | -0.041 | 0.001 | <0.001 | 0.001 | 116.370 | -1.597 | [-0.092, 0.010] | 0.113 |
| PT_Assistance | 0.003 | <0.001 | <0.001 | <0.001 | 120.607 | 1.388 | [-0.001, 0.006] | 0.168 |
| PT_Teaching_Learning | 0.003 | <0.001 | <0.001 | <0.001 | 114.394 | 0.258 | [-0.018, 0.024] | 0.797 |
| PT_Housekeeping | 0.004 | <0.001 | <0.001 | <0.001 | 117.745 | 1.160 | [-0.003, 0.010] | 0.248 |
| PT_Transportation | 0.002 | <0.001 | <0.001 | <0.001 | 78.330 | 0.945 | [-0.003, 0.007] | 0.348 |
| PT_Personal | -0.014 | <0.001 | <0.001 | <0.001 | 117.280 | -1.303 | [-0.036, 0.008] | 0.195 |
| PT_Miscellaneous | <0.001 | <0.001 | <0.001 | <0.001 | 117.135 | -0.010 | [-0.017, 0.016] | 0.992 |

Note. Q: average of the point estimates. W: within-imputation variance. B: between-imputation variance. T: total variance. df: degrees of freedom. CI: confidence interval.

The following table presents the effects of MRE on PTs of the individual tasks within medication tasks category.

| Medication Tasks | Q | W | B | T | df | t | 95% CI | p |
|---|---|---|---|---|---|---|---|---|
| PT_Medication_Documentation_Review | 0.009 | <0.001 | <0.001 | <0.001 | 110.020 | 1.497 | [-0.003, 0.021] | 0.137 |
| PT_Prep_Admin_Medications | 0.002 | <0.001 | <0.001 | <0.001 | 118.349 | 0.300 | [-0.008, 0.011] | 0.765 |
| PT_IV_Fluid_Management | -0.001 | <0.001 | <0.001 | <0.001 | 114.107 | -0.152 | [-0.011, 0.009] | 0.880 |
| PT_Obtain_Confirm_Medications | 0.010 | <0.001 | <0.001 | <0.001 | 119.104 | 2.443 | [ 0.002, 0.017] | 0.016 * |
| PT_Infusion_Pumps | <0.001 | <0.001 | <0.001 | <0.001 | 117.842 | 0.055 | [-0.005, 0.006] | 0.956 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PT_IV_Medications | -0.001 | <0.001 | <0.001 | <0.001 | 118.660 | -0.646 | [-0.005, 0.002] | 0.520 |

Note. Q: average of the point estimates. W: within-imputation variance. B: between-imputation variance. T: total variance. df: degrees of freedom. CI: confidence interval.

## 3. RQ4: MREs and Change in Workload and Negative Mood

### 3.1. Pre-observation workload and negative mood

See section "1. RQ1: Frequency of MRE-Containing Observations".

### 3.2. Change in workload

#### 3.2.1. A sample model fitting and results with one of the imputed datasets

```
lme <- lmer( ChangeWL ~ (MREO + ST + POWL + PONM)^2 + (1|Site) + (1|Subject), data = subset(data.imp, Set == 1))

# Variables:
#       ChangWL: Change in workload.
#       MREO: MRE occrrence. Binary variable.
#       ST: Shift type – day shift or night shift.
#       POWL: Pre-observation workload.
#       PONM: Pre-observation negative mood.
#       Site: Three data collection sites (ICUs). Random variable.
#       Subject: Nurse participants. Random variable.
# Input data: The first (Set == 1) of the thirty-five imputed datasets (data.imp).
```

```
Linear mixed model fit by REML
t-tests use  Satterthwaite approximations to degrees of freedom ['lmerMod']
Formula: ChangeWL ~ (MREO + ST + POWL + PONM)^2 + (1 | Site) + (1 | Subject)
   Data: subset(data.imp, Set == 1)

REML criterion at convergence: 851.2

Scaled residuals:
     Min       1Q   Median       3Q      Max
-2.11562 -0.48082  0.04792  0.41302  2.60294

Random effects:
 Groups   Name        Variance Std.Dev.
 Subject  (Intercept) 23.116   4.808
 Site     (Intercept)  1.786   1.337
 Residual             35.248   5.937
```

```
Number of obs: 124, groups:  Subject, 86; Site, 3

Fixed effects:
             Estimate Std. Error         df t value Pr(>|t|)
(Intercept)  3.114919   1.361688   4.050000   2.288   0.0833 .
MREO         3.822270   1.937729 104.530000   1.973   0.0512 .
ST           1.161603   2.151728 102.220000   0.540   0.5905
POWL        -0.225924   0.118285 112.790000  -1.910   0.0587 .
PONM         0.187067   0.083029 110.480000   2.253   0.0262 *
MREO:ST      8.845595   3.938725 111.350000   2.246   0.0267 *
MREO:POWL   -0.219480   0.186543  91.720000  -1.177   0.2424
MREO:PONM   -0.074534   0.115620  80.580000  -0.645   0.5210
ST:POWL     -0.056833   0.220016 103.100000  -0.258   0.7967
ST:PONM      0.017977   0.148039 105.350000   0.121   0.9036
POWL:PONM    0.009085   0.004938 100.430000   1.840   0.0688 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
          (Intr) MREO   ST     POWL   PONM   MREO:S MREO:POW MREO:PON ST:POW ST:PON
MREO       0.338
ST         0.511  0.290
POWL      -0.196 -0.071 -0.086
PONM       0.248  0.364  0.342  0.093
MREO:ST    0.251  0.616  0.413  0.146  0.405
MREO:POWL -0.111 -0.138  0.168  0.400  0.069  0.114
MREO:PONM  0.196  0.248  0.252  0.026  0.495  0.327  0.037
ST:POWL   -0.118  0.102 -0.210  0.569  0.018 -0.040 -0.016   -0.014
ST:PONM    0.215  0.306  0.285  0.049  0.674  0.325  0.032    0.134    0.007
POWL:PONM -0.069 -0.061 -0.102  0.016 -0.089 -0.111  0.048   -0.272    0.192 -0.246
```

### 3.2.2. Results from the same model fittings for the 35 imputed datasets combined with Rubin’s rule

The following table presents results when MREO was effects coded with weights -0.5 (absense of MRE) and 0.5 (presence of MRE). ST was also effects coded with weights -0.5 (day shift) and 0.5 (night shift).

| | Variable | Q | W | B | T | df | t | 95% CI | p |
|---|---|---|---|---|---|---|---|---|---|
| 1 | (Intercept) | 3.002 | 1.849 | 0.206 | 2.060 | 105.909 | 2.091 | [ 0.156, 5.847] | 0.039 * |
| 2 | MREO | 4.567 | 3.706 | 0.708 | 4.434 | 94.370 | 2.169 | [ 0.386, 8.747] | 0.033 * |
| 3 | ST | 2.098 | 3.979 | 0.419 | 4.410 | 106.803 | 0.999 | [-2.065, 6.261] | 0.320 |
| 4 | POWL | -0.317 | 0.013 | 0.003 | 0.016 | 86.265 | -2.520 | [-0.566, -0.067] | 0.014 * |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 5 | PONM | 0.170 | 0.007 | 0.003 | 0.010 | 67.775 | 1.720 | [-0.027, 0.367] | 0.090 |
| 6 | MREO:ST | 8.646 | 14.293 | 1.732 | 16.075 | 104.424 | 2.157 | [ 0.696, 16.597] | 0.033 * |
| 7 | MREO:POWL | -0.280 | 0.033 | 0.013 | 0.047 | 70.112 | -1.300 | [-0.711, 0.150] | 0.198 |
| 8 | MREO:PONM | 0.074 | 0.018 | 0.012 | 0.031 | 52.255 | 0.425 | [-0.276, 0.425] | 0.673 |
| 9 | ST:POWL | 0.009 | 0.041 | 0.009 | 0.051 | 89.357 | 0.040 | [-0.440, 0.458] | 0.969 |
| 10 | ST:PONM | 0.182 | 0.021 | 0.013 | 0.034 | 57.154 | 0.991 | [-0.186, 0.551] | 0.326 |
| 11 | POWL:PONM | 0.005 | <0.001 | <0.001 | <0.001 | 22.883 | 0.508 | [-0.015, 0.025] | 0.617 |

Note. Q: average of the point estimates. W: within-imputation variance. B: between-imputation variance. T: total variance. df: degrees of freedom. CI: confidence interval.

The following table presents results when ST was dummy coded with night shift as the reference level.

| | Variable | Q | W | B | T | df | t | 95% CI | p |
|---|---|---|---|---|---|---|---|---|---|
| 1 | (Intercept) | 4.051 | 4.117 | 0.329 | 4.456 | 110.643 | 1.919 | [-0.132, 8.234] | 0.058 |
| 2 | MREO | 8.890 | 11.662 | 1.545 | 13.251 | 102.746 | 2.442 | [ 1.670, 16.110] | 0.016 * |
| 3 | ST | -2.098 | 3.979 | 0.419 | 4.410 | 106.803 | -0.999 | [-6.261, 2.065] | 0.320 |
| 4 | POWL | -0.312 | 0.036 | 0.002 | 0.037 | 115.747 | -1.617 | [-0.694, 0.070] | 0.109 |
| 5 | PONM | 0.261 | 0.019 | 0.004 | 0.023 | 90.364 | 1.705 | [-0.043, 0.565] | 0.092 |
| 6 | MREO:ST | -8.646 | 14.293 | 1.732 | 16.075 | 104.424 | -2.157 | [-16.597, -0.696] | 0.033 * |
| 7 | MREO:POWL | -0.280 | 0.033 | 0.013 | 0.047 | 70.112 | -1.300 | [-0.711, 0.150] | 0.198 |
| 8 | MREO:PONM | 0.074 | 0.018 | 0.012 | 0.031 | 52.255 | 0.425 | [-0.276, 0.425] | 0.673 |
| 9 | ST:POWL | -0.009 | 0.041 | 0.009 | 0.051 | 89.357 | -0.040 | [-0.458, 0.440] | 0.969 |
| 10 | ST:PONM | -0.182 | 0.021 | 0.013 | 0.034 | 57.154 | -0.991 | [-0.551, 0.186] | 0.326 |
| 11 | POWL:PONM | 0.005 | <0.001 | <0.001 | <0.001 | 22.883 | 0.508 | [-0.015, 0.025] | 0.617 |

Note. Q: average of the point estimates. W: within-imputation variance. B: between-imputation variance. T: total variance. df: degrees of freedom. CI: confidence interval.

### 3.3. Change in negative mood

A sample model fitting is not presented in this section as the models were similar to the one presented in 3.1.1. The following table presents the results from the same model fittings for the 35 imputed datasets combined with Rubin's rule. MREO was effects coded with weights -0.5 (absense of MRE) and 0.5 (presence of MRE). ST was also effects coded with weights -0.5 (day shift) and 0.5 (night shift).

| | Variable | Q | W | B | T | df | t | 95% CI | p |
|---|---|---|---|---|---|---|---|---|---|
| 1 | (Intercept) | 2.263 | 1.752 | 0.353 | 2.115 | 92.921 | 1.556 | [-0.625, 5.151] | 0.123 |
| 2 | MREO | 1.108 | 6.558 | 1.429 | 8.028 | 90.781 | 0.391 | [-4.521, 6.736] | 0.697 |
| 3 | ST | 2.514 | 6.668 | 1.332 | 8.038 | 93.183 | 0.887 | [-3.116, 8.145] | 0.377 |
| 4 | POWL | -0.093 | 0.022 | 0.005 | 0.027 | 92.295 | -0.569 | [-0.416, 0.231] | 0.571 |
| 5 | PONM | -0.030 | 0.011 | 0.005 | 0.017 | 66.513 | -0.231 | [-0.288, 0.229] | 0.818 |
| 6 | MREO:ST | 7.613 | 25.307 | 2.934 | 28.324 | 105.214 | 1.431 | [-2.939, 18.166] | 0.156 |
| 7 | MREO:POWL | -0.143 | 0.060 | 0.022 | 0.083 | 73.561 | -0.498 | [-0.717, 0.431] | 0.620 |
| 8 | MREO:PONM | 0.104 | 0.032 | 0.021 | 0.054 | 54.191 | 0.447 | [-0.361, 0.568] | 0.657 |
| 9 | ST:POWL | -0.016 | 0.070 | 0.018 | 0.089 | 85.042 | -0.053 | [-0.609, 0.577] | 0.958 |
| 10 | ST:PONM | -0.018 | 0.035 | 0.028 | 0.064 | 47.976 | -0.070 | [-0.525, 0.49] | 0.944 |
| 11 | POWL:PONM | 0.001 | <0.001 | <0.001 | <0.001 | 23.433 | 0.103 | [-0.025, 0.027] | 0.919 |

Note. Q: average of the point estimates. W: within-imputation variance. B: between-imputation variance. T: total variance. df: degrees of freedom. CI: confidence interval.