

Supplementary material

Article title

Effects of reducing the number of quick returns (<11h off between shifts) on turnover intention and job satisfaction: a cluster-randomized controlled trial among healthcare workers

Journal name

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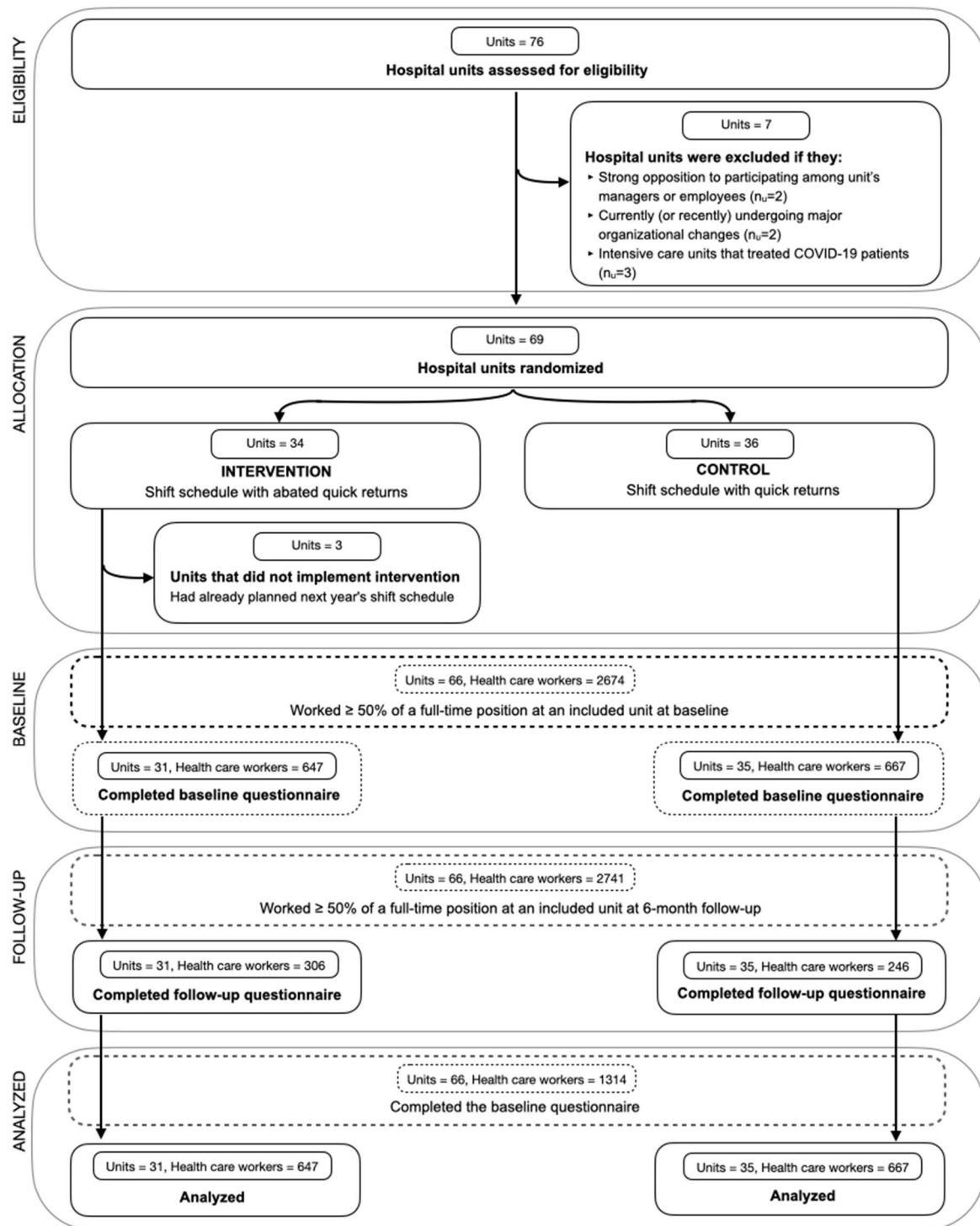
Appendix A

- **Supplemental Fig. 1** Flow chart
- **Supplemental Fig. 2** Estimates from linear mixed models
- **Supplemental Tables 1–4** Results from linear mixed models

Appendix B

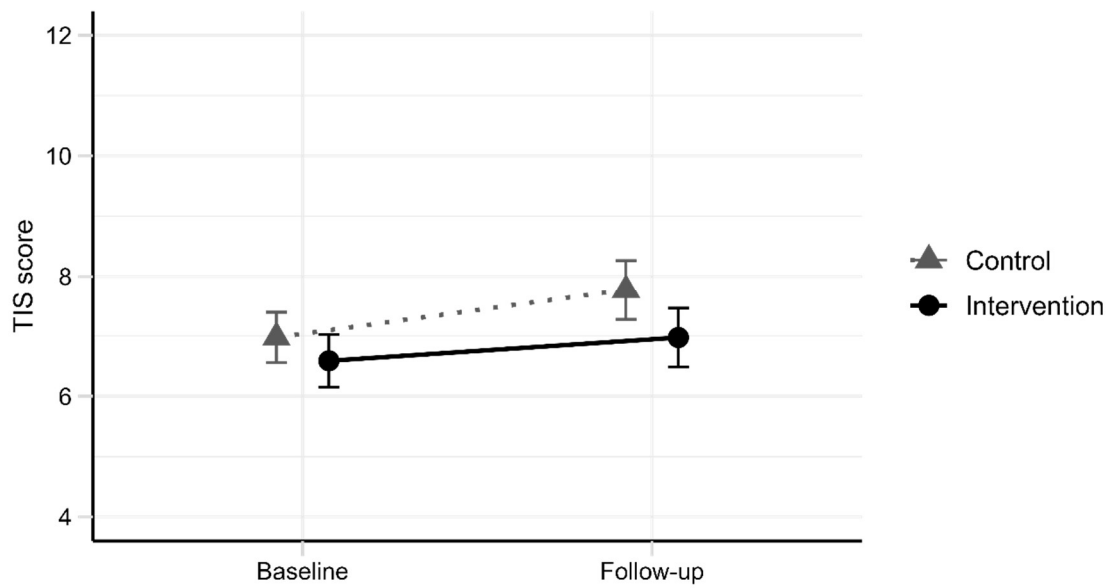
- **Supplemental Tables B1–B11** Model comparison tables

Appendix A

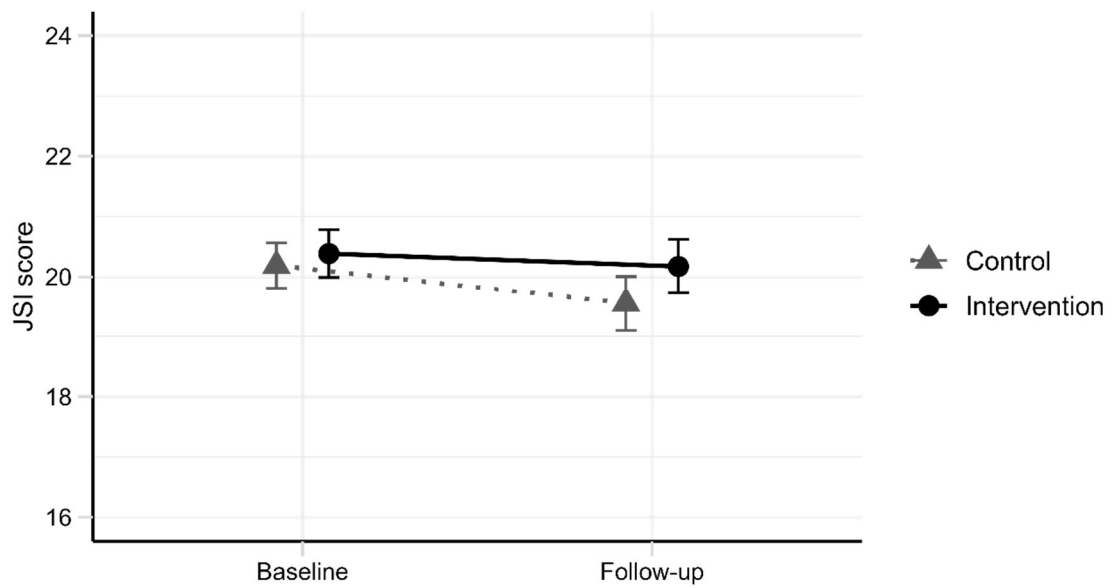


Supplemental Fig. 1 Flow of hospital units and participants (healthcare workers) in the trial. Adapted from Djupedal et al. 2024, Sleep 47(7):zsae086

(a)



(b)



Supplemental Fig. 2 Scores on the Turnover Intention Scale (TIS) **a**, and the Job Satisfaction Index (JSI) **b**, as a function of experiment group (control vs. intervention) and time (baseline vs. follow-up). The figures show the estimated marginal means with error bars representing 95% confidence intervals

Supplemental Table 1 Results from the linear mixed models for the Turnover Intention Scale and the Job Satisfaction Index

<i>Predictors</i>	Turnover Intention Scale				Job Satisfaction Index			
	<i>Estimates</i>	<i>95% CI</i>	<i>Statistic</i>	<i>p</i>	<i>Estimates</i>	<i>95% CI</i>	<i>Statistic</i>	<i>p</i>
Intercept	7.02	6.61 – 7.44	33.22	<.001	20.14	19.76 – 20.51	105.43	<.001
Follow-up	0.57	0.34 – 0.81	4.76	<.001	-0.41	-0.63 – -0.18	-3.57	.001
Intervention	-0.48	-1.08 – 0.11	-1.59	.111	0.30	-0.24 – 0.83	1.08	.279
σ^2	4.49				4.01			
T00 ID	5.96				5.90			
T00 UNIT	0.99				0.74			
ICC	0.61				0.62			
Marginal/Conditional R ²	0.010 / 0.612				0.005 / 0.625			

n ID=1314. *n* UNIT=66. *n* observations=1866. *CI*: Confidence Intervals, σ^2 : residual variance, T00: random intercept variance, *ICC*: intraclass correlation

Supplemental Table 2 Results from the linear mixed models including Age as a moderator

<i>Predictors</i>	Turnover Intention Scale				Job Satisfaction Index			
	<i>Estimates</i>	<i>95% CI</i>	<i>Statistic</i>	<i>p</i>	<i>Estimates</i>	<i>95% CI</i>	<i>Statistic</i>	<i>p</i>
Intercept	6.68	6.12 – 7.23	23.63	<.001	20.08	19.57 – 20.60	76.68	<.001
42–68 y	0.25	-0.42 – 0.93	0.74	.552	0.45	-0.19 – 1.09	1.39	.282
Follow-up	0.85	0.26 – 1.44	2.83	.019	-0.61	-1.17 – -0.05	-2.15	.128
30–41 y	0.74	0.10 – 1.39	2.25	.073	-0.28	-0.89 – 0.33	-0.89	.563
Intervention	-0.34	-1.15 – 0.47	-0.82	.548	0.55	-0.20 – 1.30	1.44	.282
Intervention:42–68 y	-0.81	-1.79 – 0.16	-1.63	.205	-0.12	-1.04 – 0.80	-0.26	.867
Intervention:30–41 y	0.25	-0.70 – 1.20	0.52	.602	-0.12	-1.01 – 0.77	-0.27	.867
Follow-up:42–68 y	-0.36	-1.22 – 0.50	-0.83	.548	-0.05	-0.86 – 0.76	-0.12	.902
Follow-up:30–41 y	0.81	-0.11 – 1.73	1.73	.199	-0.68	-1.55 – 0.18	-1.54	.282
Follow-up:Intervention	0.23	-0.59 – 1.05	0.55	.602	-0.30	-1.07 – 0.47	-0.76	.598
Follow-up:Intervention:42–68 y	-0.51	-1.68 – 0.66	-0.85	.548	1.06	-0.05 – 2.16	1.88	.182
Follow-up:Intervention:30–41 y	-1.93	-3.17 – -0.70	-3.07	.013	1.54	0.37 – 2.70	2.59	.059
σ^2		4.36				3.89		
τ_{00} ID		5.71				5.10		
τ_{00} UNIT		0.95				0.76		
ICC		0.60				0.60		
Marginal/Conditional R ²		0.045 / 0.622				0.031 / 0.614		

n ID=1091. n UNIT=66. n observations=1587. *CI*: Confidence Intervals, σ^2 : residual variance, τ_{00} : random intercept variance, *ICC*: intraclass correlation. p values adjusted with Benjamini-Hochberg corrections.

Age was included as a categorical moderator with three groups: 18–29 years (reference), 30–41 years, and 42–68 years. “Follow-up” refers to the 6-month follow-up measurement (baseline is the reference). “Intervention” represents the intervention group (control is the reference). Interaction terms reflect the combined effect of the respective variables (e.g., “Follow-up:Intervention” indicates the intervention effect at follow-up). Three-way interactions (e.g., “Follow-up:Intervention:30–41 y”) indicates whether the intervention effect at follow-up differs across age groups. Estimates reflect fixed-effect coefficients from the linear mixed models.

Supplemental Table 3 Results from the linear mixed model including Age & Children at home as a moderator

<i>Predictors</i>	Turnover Intention Scale			
	<i>Estimates</i>	<i>95% CI</i>	<i>Statistic</i>	<i>p</i>
Intercept	6.68	6.12 – 7.23	23.63	<.001
Follow-up	0.84	0.24 – 1.44	2.76	.035
Intervention	-0.46	-1.28 – 0.36	-1.11	.460
21–29 y, having children	0.11	-1.86 – 2.08	0.11	.948
30–41 y, no children	0.55	-0.25 – 1.35	1.35	.426
30–41 y, having children	0.98	0.16 – 1.79	2.35	.090
Intervention:30–41 y, no children	0.57	-0.64 – 1.78	0.92	.551
Intervention:30–41 y, having children	0.13	-1.03 – 1.30	0.23	.948
Intervention:42–68 y, no children	-0.45	-1.65 – 0.76	-0.73	.659
Intervention:42–68 y, having children	-0.92	-2.12 – 0.27	-1.51	.391
Intervention:21–29 y, having children	1.47	-1.13 – 4.07	1.11	.460
42–68 y, no children	-0.12	-0.97 – 0.72	-0.28	.948
42–68 y, having children	0.62	-0.22 – 1.45	1.45	.391
Follow-up:30–41 y, no children	1.67	0.55 – 2.79	2.92	.029
Follow-up:30–41 y, having children	-0.20	-1.41 – 1.00	-0.33	.948
Follow-up:42–68 y, no children	-0.67	-1.71 – 0.37	-1.27	.447
Follow-up:42–68 y, having children	0.04	-1.06 – 1.13	0.06	.948
Follow-up:21–29 y, having children	0.24	-2.88 – 3.37	0.15	.948
Follow-up:Intervention	0.39	-0.45 – 1.23	0.90	.551
Follow-up:Intervention:30–41 y, no children	-2.73	-4.29 – -1.17	-3.43	.008
Follow-up:Intervention:30–41 y, having children	-1.21	-2.76 – 0.34	-1.53	.391
Follow-up:Intervention:42–68 y, no children	-0.14	-1.57 – 1.28	-0.20	.948
Follow-up:Intervention:42–68 y, having children	-1.26	-2.73 – 0.20	-1.69	.363
Follow-up:Intervention:21–29 y, having children	-2.14	-5.93 – 1.64	-1.11	.460
σ^2		4.32		
τ_{00} ID		5.75		
τ_{00} UNIT		0.90		
ICC		0.61		
Marginal/Conditional R^2		0.053 / 0.627		

n ID=1091. n UNIT=66. n observations=1587. *CI*: Confidence Intervals, σ^2 : residual variance, τ_{00} : random intercept variance, *ICC*: intraclass correlation. p values adjusted with Benjamini-Hochberg corrections.

Age & children at home was coded as a combined categorical moderator. The following categories were included: “30–41 y, no children”, “30–41 y, having children”, “42–68 y, no children”, “42–68 y, having children”, and “21–29 y, having children”. The reference category was the youngest group without children (18–21 y, no children). “Follow-up” refers to the 6-month measurement (baseline is the reference). “Intervention” represents the intervention group (control is the reference). Interaction terms (e.g., “Follow-up:30–41 y, no children”) show how the change from baseline differs across groups. Three-way interactions (e.g., “Follow-up:Intervention:30–41 y, no children”) indicates whether the intervention effect over time differs between the age/children groups. Estimates reflect fixed-effect coefficients from the linear mixed models.

Supplemental Table 4 Results from the linear mixed model including Commuting time as a moderator

<i>Predictors</i>	Turnover Intention Scale			
	<i>Estimates</i>	<i>95% CI</i>	<i>Statistic</i>	<i>p</i>
Intercept	6.95	6.52 – 7.38	31.94	<0.001
Follow-up	0.73	0.36 – 1.10	3.89	<0.001
Intervention	-0.46	-1.08 – 0.15	-1.47	0.283
Intervention:>45 min	0.68	-0.42 – 1.78	1.21	0.316
>45 min	0.19	-0.56 – 0.95	0.50	0.615
Follow-up:>45 min	0.70	-0.46 – 1.87	1.18	0.316
Follow-up: Intervention	-0.24	-0.74 – 0.26	-0.95	0.391
Follow-up: Intervention:>45 min	-1.65	-3.21 – -0.10	-2.09	0.098
σ^2		4.45		
T00 ID		5.98		
T00 UNIT		0.98		
ICC		0.61		
Marginal/Conditional R ²		0.015 / 0.616		

n ID=1314. *n* UNIT=66. *n* observations = 1866. *CI*: Confidence Intervals, σ^2 : residual variance, T00: random intercept variance, *ICC*: intraclass correlation. *p* values adjusted with Benjamini-Hochberg corrections

Appendix B

Main analysis

Supplemental Table B1a Turnover Intention Scale

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9558.49	9580.61	-4775.24	9550.49	NA		
Main effects model	6	9538.18	9571.37	-4763.09	9526.18	24.30	2	<.001
Interaction effects model	7	9537.29	9576.01	-4761.65	9523.29	2.89	1	0.089

n=1314

Supplemental Table B1b Job Satisfaction Index

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9413.34	9435.46	-4702.67	9405.34	NA		
Main effects model	6	9403.72	9436.91	-4695.86	9391.72	13.62	2	0.001
Interaction effects model	7	9402.26	9440.98	-4694.13	9388.26	3.46	1	0.063

n=1314

Moderator analyses

Supplemental Table B2a Turnover Intention Scale. Moderator: Sex

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9445.71	9467.79	-4718.85	9437.71	NA		
Main effects model	6	9425.19	9458.31	-4706.59	9413.19	24.52	2	<.001
Interaction effects model	7	9424.88	9463.51	-4705.44	9410.88	2.31	1	0.129
Moderator effects model	11	9426.26	9486.98	-4702.13	9404.26	6.62	4	0.158

n=1299

Supplemental Table B2b Job Satisfaction Index. Moderator: Sex

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9298.08	9320.16	-4645.04	9290.08	NA		
Main effects model	6	9288.97	9322.09	-4638.49	9276.97	13.11	2	0.001
Interaction effects model	7	9287.51	9326.15	-4636.76	9273.51	3.46	1	0.063
Moderator effects model	11	9293.28	9353.99	-4635.64	9271.28	2.23	4	0.693

n=1299

Supplemental Table B3a Turnover Intention Scale. Moderator: Age

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	8111.59	8133.07	-4051.79	8103.59	NA		
Main effects model	6	8086.34	8118.56	-4037.17	8074.34	29.24	2	<.001
Interaction effects model	7	8084.47	8122.05	-4035.23	8070.47	3.88	1	0.049
Moderator effects model	15	8058.44	8138.98	-4014.22	8028.44	42.03	8	<.001

n=1091

Supplemental Table B3b Job Satisfaction Index. Moderator: Age

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	7901.83	7923.30	-3946.91	7893.83	NA		
Main effects model	6	7883.69	7915.90	-3935.84	7871.69	22.14	2	<.001
Interaction effects model	7	7881.15	7918.74	-3933.58	7867.15	4.53	1	0.033
Moderator effects model	15	7872.65	7953.20	-3921.33	7842.65	24.50	8	0.002

n=1091

Supplemental Table B4a Turnover Intention Scale. Moderator: Marital status

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9558.49	9580.61	-4775.24	9550.49	NA		
Main effects model	6	9538.18	9571.37	-4763.09	9526.18	24.30	2	<.001
Interaction effects model	7	9537.29	9576.01	-4761.65	9523.29	2.89	1	0.089
Moderator effects model	11	9529.35	9590.20	-4753.68	9507.35	15.94	4	0.003

n=1314

Supplemental Table B4b Job Satisfaction Index. Moderator: Marital status

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9413.34	9435.46	-4702.67	9405.34	NA		
Main effects model	6	9403.72	9436.91	-4695.86	9391.72	13.62	2	0.001
Interaction effects model	7	9402.26	9440.98	-4694.13	9388.26	3.46	1	0.063
Moderator effects model	11	9403.78	9464.63	-4690.89	9381.78	6.48	4	0.166

n=1314

Supplemental Table B5a Turnover Intention Scale. Moderator: Children at home

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9558.49	9580.61	-4775.24	9550.49	NA		
Main effects model	6	9538.18	9571.37	-4763.09	9526.18	24.30	2	<.001
Interaction effects model	7	9537.29	9576.01	-4761.65	9523.29	2.89	1	0.089
Moderator effects model	11	9533.39	9594.24	-4755.69	9511.39	11.90	4	0.018

n=1314

Supplemental Table B5b Job Satisfaction Index. Moderator: Children at home

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9413.34	9435.46	-4702.67	9405.34	NA		
Main effects model	6	9403.72	9436.91	-4695.86	9391.72	13.62	2	0.001
Interaction effects model	7	9402.26	9440.98	-4694.13	9388.26	3.46	1	0.063
Moderator effects model	11	9396.49	9457.34	-4687.24	9374.49	13.77	4	0.008

n=1314

Supplemental Table B6a Turnover Intention Scale. Moderator: Age & Children at home

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	8111.59	8133.07	-4051.79	8103.59	NA		
Main effects model	6	8086.34	8118.56	-4037.17	8074.34	29.24	2	<.001
Interaction effects model	7	8084.47	8122.05	-4035.23	8070.47	3.88	1	0.049
Moderator effects model	27	8064.61	8209.59	-4005.30	8010.61	59.86	20	<.001

n=1091

Supplemental Table B6b Job Satisfaction Index. Moderator: Age & Children at home

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	7901.83	7923.30	-3946.91	7893.83	NA		
Main effects model	6	7883.69	7915.90	-3935.84	7871.69	22.14	2	<.001
Interaction effects model	7	7881.15	7918.74	-3933.58	7867.15	4.53	1	0.033
Moderator effects model	27	7875.77	8020.75	-3910.89	7821.77	45.38	20	<.001

n=1091

Supplemental Table B7a Turnover Intention Scale. Moderator: Commuting time

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9558.49	9580.61	-4775.24	9550.49	NA		
Main effects model	6	9538.18	9571.37	-4763.09	9526.18	24.30	2	<.001
Interaction effects model	7	9537.29	9576.01	-4761.65	9523.29	2.89	1	0.089
Moderator effects model	11	9537.16	9598.00	-4757.58	9515.16	8.14	4	0.087

n=1314

Supplemental Table B7b Job Satisfaction Index. Moderator: Commuting time

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9413.34	9435.46	-4702.67	9405.34	NA		
Main effects model	6	9403.72	9436.91	-4695.86	9391.72	13.62	2	0.001
Interaction effects model	7	9402.26	9440.98	-4694.13	9388.26	3.46	1	0.063
Moderator effects model	11	9404.74	9465.59	-4691.37	9382.74	5.51	4	0.239

n=1314

Supplemental Table B8a Turnover Intention Scale. Moderator: Education

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9558.49	9580.61	-4775.24	9550.49	NA		
Main effects model	6	9538.18	9571.37	-4763.09	9526.18	24.30	2	<.001
Interaction effects model	7	9537.29	9576.01	-4761.65	9523.29	2.89	1	0.089
Moderator effects model	15	9539.36	9622.33	-4754.68	9509.36	13.93	8	0.084

n=1314

Supplemental Table B8b Job Satisfaction Index. Moderator: Education

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9413.34	9435.46	-4702.67	9405.34	NA		
Main effects model	6	9403.72	9436.91	-4695.86	9391.72	13.62	2	0.001
Interaction effects model	7	9402.26	9440.98	-4694.13	9388.26	3.46	1	0.063
Moderator effects model	15	9404.16	9487.13	-4687.08	9374.16	14.10	8	0.079

n=1314

Supplemental Table B9a Turnover Intention Scale. Moderator: rMEQ

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9558.49	9580.61	-4775.24	9550.49	NA		
Main effects model	6	9538.18	9571.37	-4763.09	9526.18	24.30	2	<.001
Interaction effects model	7	9537.29	9576.01	-4761.65	9523.29	2.89	1	0.089
Moderator effects model	15	9546.84	9629.81	-4758.42	9516.84	6.45	8	0.597

n=1314

Supplemental Table B9b Job Satisfaction Index. Moderator: rMEQ

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9413.34	9435.46	-4702.67	9405.34	NA		
Main effects model	6	9403.72	9436.91	-4695.86	9391.72	13.62	2	0.001
Interaction effects model	7	9402.26	9440.98	-4694.13	9388.26	3.46	1	0.063
Moderator effects model	15	9406.28	9489.25	-4688.14	9376.28	11.98	8	0.152

n=1314

Supplemental Table B10a Turnover Intention Scale. Moderator: rCTI flexibility

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9558.49	9580.61	-4775.24	9550.49	NA		
Main effects model	6	9538.18	9571.37	-4763.09	9526.18	24.30	2	<.001
Interaction effects model	7	9537.29	9576.01	-4761.65	9523.29	2.89	1	0.089
Moderator effects model	15	9528.11	9611.08	-4749.05	9498.11	25.19	8	0.001

n=1314

Supplemental Table B10b Job Satisfaction Index. Moderator: rCTI flexibility

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9413.34	9435.46	-4702.67	9405.34	NA		
Main effects model	6	9403.72	9436.91	-4695.86	9391.72	13.62	2	0.001
Interaction effects model	7	9402.26	9440.98	-4694.13	9388.26	3.46	1	0.063
Moderator effects model	15	9397.24	9480.21	-4683.62	9367.24	21.02	8	0.007

n=1314

Supplemental Table B11a Turnover Intention Scale. Moderator: rCTI languidity

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9558.49	9580.61	-4775.24	9550.49	NA		
Main effects model	6	9538.18	9571.37	-4763.09	9526.18	24.30	2	<.001
Interaction effects model	7	9537.29	9576.01	-4761.65	9523.29	2.89	1	0.089
Moderator effects model	15	9516.48	9599.45	-4743.24	9486.48	36.81	8	<.001

n=1314

Supplemental Table B11b Job Satisfaction Index. Moderator: rCTI languidity

Model	Npar	AIC	BIC	Log-Likelihood	Deviance	Chi-Square	DF	p-value
Random effects model	4	9413.34	9435.46	-4702.67	9405.34	NA		
Main effects model	6	9403.72	9436.91	-4695.86	9391.72	13.62	2	0.001
Interaction effects model	7	9402.26	9440.98	-4694.13	9388.26	3.46	1	0.063
Moderator effects model	15	9376.17	9459.14	-4673.08	9346.17	42.09	8	<.001

n=1314