Supplementary material: Contents:

Supplementary material: Abbreviations

N.S	Not significant/not significantly/non-significant
EEG	Electroencephalogram
BS	Before shift
PI	Post intervention
AS	After shift
IV	Intravenous
ED	Emergency department
EM	Emergency medicine
IM	Internal medicine
M/F	Male/Female
ENT	Ear nose and throat
GP	General Practitioner
No.	Number

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Supplementary material: Search strategy

Ovid Embase Classic + Embase 1947 – 2021 June 06

1	exp physician/ OR exp resident/
2	(doctor* OR physician* OR resident*).ab,ti
3	#1 OR #2
4	exp rest/
5	(break OR breakroom OR breaks OR break-time OR break-taking OR doctors mess OR micro-break* OR microbreak* OR nap OR napping OR naps OR rest OR rest-break* OR restful OR resting OR sleep OR sleeping OR work-break*).ab,ti
6	#4 OR #5
7	exp "occupation and occupation related phenomena"/
8	(duty OR duties OR employee* OR employment OR internship* OR job OR jobs OR occupation* OR on-call OR on-shift OR organisation* OR organization* OR profession* OR rotation* OR rota* OR shift OR shifts OR shift-work OR shift-working OR staff OR work OR workday* OR work environment* OR worker* OR workforce OR working OR workload OR workplace OR work-related).ab,ti
9	#7 OR #8
10	#3 AND #6 AND #9
11	exp health/ OR exp wellbeing/ OR exp occupational health/ OR exp medical error/ OR exp work/ OR exp occupational science/
12	(absenteeism OR anxiety OR anxious OR burnout OR depression OR depressive OR employee health OR exhaustion OR fatigue OR mental health OR musculoskeletal OR occupational health OR occupational disease* OR occupational injury OR occupational injuries OR presenteeism OR quality of life OR recovery OR resilience OR resiliency OR sick note* OR sickness absence* OR sickness leave OR sick leave OR sleepiness OR staff absence* OR staff leave OR stress OR tiredness OR turnover OR wakefulness OR well-being OR wellbeing OR well being OR wellness OR well-ness OR work absence*).ab,ti
13	(ability to concentrate OR adverse event* OR alertness OR appraisal* OR assess* performance OR care quality OR claim* by patient* OR care of patient* OR care for patient* OR clinical performance OR clinical outcome* OR competen* at work OR concentration OR consultation satisfaction OR deadline* OR death rate* OR feedback OR fit* to practice OR fit* to practise OR decision-making OR decision making OR industrial safety OR industrial health OR infection rate* OR job dedication OR job effectiveness OR job efficiency OR job engagement OR job motivation OR job performance OR job satisfaction OR job skill* OR job productivity OR medical error* OR medical mistake* OR medical negligenc* OR meet* objective* OR mental acuity OR occupational safety OR organisational citizenship OR organizational citizenship OR patient care OR patient complaint* OR patient claim* OR patient death* OR patient outcome* OR patient mortality OR patient satisfaction OR patient wait* time* OR perform task* OR performance assess* OR prevention uptake rate* OR quality of work OR quality of care OR quality indicat* OR quality of service OR reaction speed* OR reaction time* OR readmission* rate* OR referral rate* OR revalidation OR service provision OR significant event* OR standard* of care OR surgery rate* OR target* OR task performance OR teamwork OR treatment outcome* OR wait* list* OR wait* time* OR work capacity OR working effectively OR working efficiently OR work engagement OR work performance OR work productivity OR work quality).ab,ti
14	("friends and family test*").ab,ti
15	#11 OR #12 OR #13 OR #14
16	#10 AND #15

PubMed

1	physician [MeSH] OR "Internship and Residency"[MeSH]
2	doctor*[Title/Abstract] OR physician*[Title/Abstract] OR resident* [Title/Abstract]
3	#1 OR #2
4	"rest"[MeSH]
5	break[Title/Abstract] OR breakroom[Title/Abstract] OR breaks OR breaktime[Title/Abstract] OR break-taking[Title/Abstract] OR "doctors mess"[Title/Abstract] OR "doctor's mess"[Title/Abstract] OR micro-break*[Title/Abstract] OR microbreak*[Title/Abstract] OR nap[Title/Abstract] OR napping[Title/Abstract] OR naps[Title/Abstract] OR rest[Title/Abstract] OR rest-break*[Title/Abstract] OR restful[Title/Abstract] OR resting[Title/Abstract] OR sleep[Title/Abstract] OR sleeping[Title/Abstract] OR work-break*[Title/Abstract]
6	#4 OR #5
7	work[MeSH] OR workplace[MeSH]
8	duty[Title/Abstract] OR duties[Title/Abstract] OR employee*[Title/Abstract] OR employment[Title/Abstract] OR internship*[Title/Abstract] OR job[Title/Abstract] OR jobs[Title/Abstract] OR occupation*[Title/Abstract] OR on-call[Title/Abstract] OR on-shift[Title/Abstract] OR organisation*[Title/Abstract] OR organization*[Title/Abstract] OR profession*[Title/Abstract] OR rotation*[Title/Abstract] OR rota*[Title/Abstract] OR shift[Title/Abstract] OR shifts[Title/Abstract] OR shift-work[Title/Abstract] OR shift-working[Title/Abstract] OR staff[Title/Abstract] OR work[Title/Abstract] OR workday*[Title/Abstract] OR "work environment*"[Title/Abstract] OR worker* OR workforce[Title/Abstract] OR working[Title/Abstract] OR workload[Title/Abstract] OR workplace[Title/Abstract] OR work-related[Title/Abstract]
9	#7 OR #8
10	#3 AND #6 AND #9
11	"occupational health"[MeSH] OR "mental health"[MeSH] OR "medical errors"[MeSH] OR "work performance"[MeSH]
12	absenteeism[Title/Abstract] OR anxiety[Title/Abstract] OR anxious[Title/Abstract] OR burnout[Title/Abstract] OR depression[Title/Abstract] OR depressive[Title/Abstract] OR employee health[Title/Abstract] OR exhaustion[Title/Abstract] OR fatigue[Title/Abstract] OR mental health[Title/Abstract] OR musculoskeletal[Title/Abstract] OR occupational health[Title/Abstract] OR occupational disease*[Title/Abstract] OR occupational injury[Title/Abstract] OR occupational injuries[Title/Abstract] OR presenteeism[Title/Abstract] OR quality of life[Title/Abstract] OR recovery[Title/Abstract] OR resilience[Title/Abstract] OR resiliency[Title/Abstract] OR sick note*[Title/Abstract] OR sickness absence*[Title/Abstract] OR sickness leave[Title/Abstract] OR sick leave[Title/Abstract] OR sleepiness[Title/Abstract] OR staff absence*[Title/Abstract] OR staff leave[Title/Abstract] OR stress[Title/Abstract] OR tiredness[Title/Abstract] OR turnover[Title/Abstract] OR wakefulness[Title/Abstract] OR well-being[Title/Abstract] OR wellbeing[Title/Abstract] OR well being[Title/Abstract] OR wellness[Title/Abstract] OR well-ness[Title/Abstract] OR work absence*[Title/Abstract]
13	ability to concentrate[Title/Abstract] OR adverse event*[Title/Abstract] OR alertness[Title/Abstract] OR appraisal*[Title/Abstract] OR assess* performance[Title/Abstract] OR care quality[Title/Abstract] OR claim* by patient*[Title/Abstract] OR care of patient*[Title/Abstract] OR care for patient*[Title/Abstract] OR clinical performance[Title/Abstract] OR clinical outcome*[Title/Abstract] OR competen* at work[Title/Abstract] OR concentration[Title/Abstract] OR consultation satisfaction[Title/Abstract] OR deadline*[Title/Abstract] OR death rate*[Title/Abstract] OR feedback[Title/Abstract] OR fit* to practice[Title/Abstract] OR fit* to practise[Title/Abstract] OR decision-making[Title/Abstract] OR decision making[Title/Abstract] OR industrial safety[Title/Abstract] OR industrial health[Title/Abstract] OR infection rate*[Title/Abstract] OR job dedication[Title/Abstract] OR job effectiveness[Title/Abstract] OR job efficiency[Title/Abstract] OR job engagement[Title/Abstract] OR job motivation[Title/Abstract] OR job

	performance[Title/Abstract] OR job satisfaction[Title/Abstract] OR job skill*[Title/Abstract] OR job productivity[Title/Abstract] OR medical error*[Title/Abstract] OR medical mistake*[Title/Abstract] OR medical negligenc*[Title/Abstract] OR meet* objective*[Title/Abstract] OR mental acuity[Title/Abstract] OR occupational safety[Title/Abstract] OR organisational citizenship[Title/Abstract] OR organizational citizenship[Title/Abstract] OR patient care[Title/Abstract] OR patient complaint*[Title/Abstract] OR patient claim*[Title/Abstract] OR patient death*[Title/Abstract] OR patient outcome*[Title/Abstract] OR patient mortality[Title/Abstract] OR patient satisfaction[Title/Abstract] OR patient wait* time*[Title/Abstract] OR perform task*[Title/Abstract] OR performance assess*[Title/Abstract] OR prevention uptake rate*[Title/Abstract] OR quality of work[Title/Abstract] OR quality of care[Title/Abstract] OR quality indicat*[Title/Abstract] OR quality of service[Title/Abstract] OR reaction speed*[Title/Abstract] OR reaction time*[Title/Abstract] OR readmission* rate*[Title/Abstract] OR referral rate*[Title/Abstract] OR revalidation[Title/Abstract] OR service provision[Title/Abstract] OR significant event*[Title/Abstract] OR standard* of care[Title/Abstract] OR surgery rate*[Title/Abstract] OR target*[Title/Abstract] OR task performance[Title/Abstract] OR teamwork[Title/Abstract] OR treatment outcome*[Title/Abstract] OR wait* list*[Title/Abstract] OR wait* time*[Title/Abstract] OR work capacity[Title/Abstract] OR working effectively[Title/Abstract] OR working efficiently[Title/Abstract] OR work engagement[Title/Abstract] OR work performance[Title/Abstract] OR work productivity[Title/Abstract] OR work quality[Title/Abstract] OR "friends and family test*"[Title/Abstract]
14	#11 OR #12 OR #13
15	#10 AND #14

Web of Science

	(Topic search selected)
1	doctor* OR physician* OR resident*
2	break OR breakroom OR breaks OR "break-time" OR "break-taking" OR "doctors mess" OR "micro-break*" OR microbreak* OR nap OR napping OR naps OR rest OR "rest-break*" OR restful OR resting OR sleep OR sleeping OR "work-break*"
3	duty OR duties OR employee* OR employment OR internship* OR job OR jobs OR occupation* OR "on-call" OR "on-shift" OR organisation* OR organization* OR profession* OR rotation* OR rota* OR shift OR shifts OR "shift-work" OR "shift-working" OR staff OR work OR workday* OR "work environment*" OR worker* OR workforce OR working OR workload OR workplace OR "work-related"
4	#1 AND #2 AND #3 = 5,854
5	#5 absenteeism OR anxiety OR anxious OR burnout OR depression OR depressive OR "employee health" OR exhaustion OR fatigue OR "mental health" OR musculoskeletal OR "occupational health" OR "occupational disease*" OR "occupational injury" OR "occupational injuries" OR presenteeism OR "quality of life" OR recovery OR resilience OR resiliency OR "sick note*" OR "sickness absence*" OR "sickness leave" OR "sick leave" OR sleepiness OR "staff absence*" OR "staff leave" OR stress OR tiredness OR turnover OR wakefulness OR "well-being" OR wellbeing OR "well being" OR wellness OR "well-ness" OR "work absence*"
6	"ability to concentrate" OR "adverse event*" OR alertness OR appraisal* OR "assess* performance" OR "care quality" OR "claim* by patient*" OR "care of patient*" OR "care for patient*" OR "clinical performance" OR "clinical outcome*" OR "competen* at work" OR concentration OR "consultation satisfaction" OR deadline* OR "death rate*" OR "decision-making" OR "decision making" OR feedback OR "fit* to practice" OR "fit* to practise" OR "friends and family test*" OR "industrial safety" OR "industrial health" OR "infection rate*" OR "job dedication" OR "job effectiveness" OR "job efficiency" OR "job engagement" OR "job motivation" OR "job performance" OR "job satisfaction" OR "job skill*" OR "job productivity" OR "medical error*" OR "medical mistake*" OR "medical negligenc*" OR "meet* objective*" OR "mental acuity" OR "occupational safety" OR "organisational citizenship" OR "organizational citizenship" OR "patient care" OR "patient complaint*" OR "patient claim*" OR "patient death*" OR "patient outcome*" OR "patient mortality"

	OR “patient satisfaction” OR “patient wait* time*” OR “perform task*” OR “performance assess*” OR “prevention uptake rate*” OR “quality of work” OR “quality of care” OR “quality indicat*” OR “quality of service” OR “reaction speed*” OR “reaction time*” OR “readmission* rate*” OR “referral rate*” OR revalidation OR “service provision” OR “significant event*” OR “standard* of care” OR “surgery rate*” OR target* OR “task performance” OR teamwork OR “treatment outcome*” OR “wait* list*” OR “wait* time*” OR “work capacity” OR “working effectively” OR “working efficiently” OR “work engagement” OR “work performance” OR “work productivity” OR “work quality”
7	#5 OR #6
8	#4 AND #7

PsycINFO

1	DE "Physicians" OR DE "Family Physicians" OR DE "General Practitioners" OR DE "Gynecologists" OR DE "Internists" OR DE "Neurologists" OR DE "Obstetricians" OR DE "Pathologists" OR DE "Pediatricians" OR DE "Psychiatrists" OR DE "Surgeons" OR DE “medical residency” OR DE “medical internship”
2	TI doctor* OR TI physician* OR AB doctor* OR AB physician* OR TI resident* OR AB resident*
3	S1 OR S2
4	DE "Relaxation" OR DE "Work Rest Cycles"
5	TI break OR TI breakroom OR TI breaks OR TI “break-time” OR TI “break-taking” OR TI “doctors mess” OR TI “micro-break*” OR TI microbreak* OR TI nap OR TI napping OR TI naps OR TI rest OR TI “rest-break*” OR TI restful OR TI resting OR TI sleep OR TI sleeping OR TI “work-break*” OR AB break OR AB breakroom OR AB breaks OR AB “break-time” OR AB “break-taking” OR AB “doctors mess” OR AB “micro-break*” OR AB microbreak* OR AB nap OR AB napping OR AB naps OR AB rest OR AB “rest-break*” OR AB restful OR AB resting OR AB sleep OR AB sleeping OR AB “work-break*”
6	S4 OR S5
7	#DE "Working Conditions" OR "Workday Shifts" OR DE "Working Space"
8	TI duty OR TI duties OR TI employee* OR TI employment OR TI internship* OR TI job OR TI jobs OR TI occupation* OR TI “on-call” OR TI “on-shift” OR TI organisation* OR TI organization* OR TI profession* OR TI rotation* OR TI rota* OR TI shift OR TI shifts OR TI “shift-work” OR TI “shift-working” OR TI staff OR TI work OR TI workday* OR TI “work environment*” OR TI worker* OR TI workforce OR TI working OR TI workload OR TI workplace OR TI “work-related” OR AB duty OR AB duties OR AB employee* OR AB employment OR AB internship* OR AB job OR AB jobs OR AB occupation* OR AB “on-call” OR AB “on-shift” OR AB organisation* OR AB organization* OR AB profession* OR AB rotation* OR AB rota* OR AB shift OR AB shifts OR AB “shift-work” OR AB “shift-working” OR AB staff OR AB work OR AB workday* OR AB “work environment*” OR AB worker* OR AB workforce OR AB working OR AB workload OR AB workplace OR AB “work-related”
9	S7 OR S8
10	S3 AND S6 AND S9 = 1,702
11	DE "Health Status" OR DE "Health Literacy" OR DE "Health Outcomes" OR DE "Mental Health" OR DE "Occupational Health" OR DE "Physical Health" OR DE "Well Being" OR DE "Spiritual Well Being" OR DE "Errors" OR DE "Patient Safety" OR DE "Job Performance" OR DE "Employee Efficiency" OR DE "Employee Productivity" OR DE "Job Satisfaction"
12	TI absenteeism OR TI anxiety OR TI anxious OR TI burnout OR TI depression OR TI depressive OR TI “employee health” OR TI exhaustion OR TI fatigue OR TI “mental health” OR TI musculoskeletal OR TI “occupational health” OR TI “occupational disease*” OR TI “occupational injury” OR TI “occupational injuries” OR TI presenteeism OR TI “quality of life” OR TI recovery OR TI resilience OR TI resiliency OR TI “sick note*” OR TI “sickness absence*” OR TI “sickness leave” OR TI “sick leave” OR TI sleepiness OR TI “staff absence*” OR TI “staff leave” OR TI stress OR TI tiredness OR TI turnover OR TI wakefulness OR TI “well-being” OR TI wellbeing OR TI “well being” OR TI wellness OR TI “well-ness” OR TI “work absence*” OR AB absenteeism OR AB anxiety OR AB anxious OR AB burnout OR AB

	depression OR AB depressive OR AB "employee health" OR AB exhaustion OR AB fatigue OR AB "mental health" OR AB musculoskeletal OR AB "occupational health" OR AB "occupational disease*" OR AB "occupational injury" OR AB "occupational injuries" OR AB presenteeism OR AB "quality of life" OR AB recovery OR AB resilience OR AB resiliency OR AB "sick note*" OR AB "sickness absence*" OR AB "sickness leave" OR AB "sick leave" OR AB sleepiness OR AB "staff absence*" OR AB "staff leave" OR AB stress OR AB tiredness OR AB turnover OR AB wakefulness OR AB "well-being" OR AB wellbeing OR AB "well being" OR AB wellness OR AB "well-ness" OR AB "work absence*"
13	TI "ability to concentrate" OR TI "adverse event*" OR TI alertness OR TI appraisal* OR TI "assess* performance" OR TI "care quality" OR TI "claim* by patient*" OR TI "care of patient*" OR TI "care for patient*" OR TI "clinical performance" OR TI "clinical outcome*" OR TI "competen* at work" OR TI concentration OR TI "consultation satisfaction" OR TI deadline* OR TI "death rate*" OR TI "decision-making" OR TI "decision making" OR TI feedback OR TI "fit* to practice" OR TI "fit* to practise" OR TI "friends and family test*" OR TI "industrial safety" OR TI "industrial health" OR TI "infection rate*" OR TI "job dedication" OR TI "job effectiveness" OR TI "job efficiency" OR TI "job engagement" OR TI "job motivation" OR TI "job performance" OR TI "job satisfaction" OR TI "job skill*" OR TI "job productivity" OR TI "medical error*" OR TI "medical mistake*" OR TI "medical negligenc*" OR TI "meet* objective*" OR TI "mental acuity" OR TI "occupational safety" OR TI "organisational citizenship" OR TI "organizational citizenship" OR TI "patient care" OR TI "patient complaint*" OR TI "patient claim*" OR TI "patient death*" OR TI "patient outcome*" OR TI "patient mortality" OR TI "patient satisfaction" OR TI "patient wait* time*" OR TI "perform task*" OR TI "performance assess*" OR TI "prevention uptake rate*" OR TI "quality of work" OR TI "quality of care" OR TI "quality indicat*" OR TI "quality of service" OR TI "reaction speed*" OR TI "reaction time*" OR TI "readmission* rate*" OR TI "referral rate*" OR TI revalidation OR TI "service provision" OR TI "significant event*" OR TI "standard* of care" OR TI "surgery rate*" OR TI target* OR TI "task performance" OR TI teamwork OR TI "treatment outcome*" OR TI "wait* list*" OR TI "wait* time*" OR TI "work capacity" OR TI "work* effectively" OR TI "work* efficiently" OR TI "work engagement" OR TI "work performance" OR TI "work productivity" OR TI "work quality" OR AB "ability to concentrate" OR AB "adverse event*" OR AB alertness OR AB appraisal* OR AB "assess* performance" OR AB "care quality" OR AB "claim* by patient*" OR AB "care of patient*" OR AB "care for patient*" OR AB "clinical performance" OR AB "clinical outcome*" OR AB "competen* at work" OR AB concentration OR AB "consultation satisfaction" OR AB deadline* OR AB "death rate*" OR AB "decision-making" OR AB "decision making" OR AB feedback OR AB "fit* to practice" OR AB "fit* to practise" OR AB "friends and family test*" OR AB "industrial safety" OR AB "industrial health" OR AB "infection rate*" OR AB "job dedication" OR AB "job effectiveness" OR AB "job efficiency" OR AB "job engagement" OR AB "job motivation" OR AB "job performance" OR AB "job satisfaction" OR AB "job skill*" OR AB "job productivity" OR AB "medical error*" OR AB "medical mistake*" OR AB "medical negligenc*" OR AB "meet* objective*" OR AB "mental acuity" OR AB "occupational safety" OR AB "organisational citizenship" OR AB "organizational citizenship" OR AB "patient care" OR AB "patient complaint*" OR AB "patient claim*" OR AB "patient death*" OR AB "patient outcome*" OR AB "patient mortality" OR AB "patient satisfaction" OR AB "patient wait* time*" OR AB "perform task*" OR AB "performance assess*" OR AB "prevention uptake rate*" OR AB "quality of work" OR AB "quality of care" OR AB "quality indicat*" OR AB "quality of service" OR AB "reaction speed*" OR AB "reaction time*" OR AB "readmission* rate*" OR AB "referral rate*" OR AB revalidation OR AB "service provision" OR AB "significant event*" OR AB "standard* of care" OR AB "surgery rate*" OR AB target* OR AB "task performance" OR AB teamwork OR AB "treatment outcome*" OR AB "wait* list*" OR AB "wait* time*" OR AB "work capacity" OR AB "work* effectively" OR AB "work* efficiently" OR AB "work engagement" OR AB "work performance" OR AB "work productivity" OR AB "work quality"
14	#11 OR #12 OR #13
15	#10 AND #14

Availability of all data collection forms, data extracted from included studies hosted on University of Southampton Website, and available on request

Supplementary Table 1. Rationale for observational cohort risk of bias assessments (JBI)

Study: Bérastégui (2020)[45]		**Study:** Hockey (2020)[46]	
No.	**Additional comments**	**No.**	**Additional comments**
Q1	No control/ comparison group	Q1	No control/ comparison group
Q2	No control/ comparison group	Q2	No control/ comparison group
Q3	Study specific qualitative tool (list of fatigue reduction strategies), validity unclear. Not objective.	Q3	Time spent on task (breaks). Objective and reliably measured.
Q4	No mention of covariates, no confounders identified.	Q4	Analysis controlled for demographic data, time at which the task (breaks) was performed and the minutes since it was started.
Q5	Model allowed control of variance from random factors	Q5	
Q6	Participants not free of outcomes prior to study commencement	Q6	Participants not free of outcomes prior to study commencement
Q7	Validity of outcomes unclear. However, measured in a reliable way	Q7	Validation studies completed showing acceptable validity
Q8	Several repeated measurements of reaction time (sufficient). Burnout measured once at baseline.	Q8	5x 2-hour periods selected across shifts (sufficient).
Q9	Authors mention there was staff turnover and new participants recruited but unclear whether this affected follow-up of the longitudinal variables	Q9	All survey responses included, regardless of quantity of surveys completed. When incomplete task data was excluded, other data from survey included.
Q10		Q10	
Q11	Statistics appear appropriate for data	Q11	Statistics appear appropriate for data
Study: Neprash (2018)[47]		**Study:** Vosshenrich (2021)[48]	
No.	**Additional comments**	**No.**	**Additional comments**
Q1	No control/ comparison group	Q1	No control/ comparison group
Q2	No control/ comparison group	Q2	No control/ comparison group
Q3	Objective and reliably measured. (Gap of >15 minutes in schedule)	Q3	Method of defining breaks does not appear reliable. Authors assume 45-min breaks taken before/after teaching at noon, when staff overlap on weekend

			shifts, and inconsistently on night shifts. Then split data into 2-hour blocks (10:00-11:59am, 12-1:59pm, etc.) and approximate reports which might be close to lunch times.
Q4	Analysis controlled for demographic characteristics, visit characteristics and differences across physicians	Q4	Proofreading behaviour consistency among staff was analysed (potential confounder). State that inclusion of a large number of cross-sectional imaging studies might exacerbate decreases in mean report similarity
Q5		Q5	Impact of cross-sectional imaging identified as confounder but not considered in analysis. Proofreading consistency over course of a day (e.g. morning vs afternoon) assumed.
Q6	Participants not free of outcome prior to study commencement	Q6	Participants not free of outcome prior to study commencement
Q7	Objective and reliable measurement (of inappropriate opioid prescription).	Q7	Objective, reliable. (Jaccard similarity coefficient)
Q8	12-month period (sufficient)	Q8	2.5 year period (sufficient).
Q9	Not applicable to retrospective cohort studies	Q9	Not applicable to retrospective cohort studies
Q10	Not applicable to retrospective cohort studies	Q10	Not applicable to retrospective cohort studies
Q11	Statistics appear appropriate for data	Q11	Statistics appear appropriate for data

Supplementary Table 2. Rationale for cross-sectional risk of bias assessments (JBI)

Study: Al Dandan (2020)[38]		**Study:** Hassan (2020)[40]	
No.	**Additional comments**	**No.**	**Additional comments**
Q1	Inclusion criteria defined	Q1	Inclusion criteria defined
Q2	Subjects described in adequate detail	Q2	Subjects described in adequate detail
Q3	Break frequency and duration measured using arbitrary study-specific time categories.	Q3	The original, validated survey does not include questions about breaks. This is an additional component without psychometric data.
Q4		Q4	
Q5	Confounding factors identified	Q5	No confounders identified
Q6	Confounders not dealt with statistically. Used multivariate logistic regression but it did not account for certain inherent confounders (e.g. mobile usage and type of corrective lenses)	Q6	
Q7	Although eye strain not diagnosed objectively, scale used was tested for face validity etc.	Q7	Stress as outcome measurement on the original HCJSSQ is validated.
Q8	Statistics appear appropriate for data	Q8	Statistics appear appropriate for data
Study: Kalboussi (2020)[43]		**Study:** Kirkcaldy (2002)[41]	
No.	**Additional comments**	**No.**	**Additional comments**
Q1	Inclusion criteria defined	Q1	Inclusion criteria defined
Q2	Subjects described in adequate detail	Q2	Subjects described in adequate detail
Q3	Breaks measured as dichotomised yes/no variable. Not clear how this was measured or defined.	Q3	Break duration measured as time of break onset and time of break cessation. Appears objective and reliable.
Q4		Q4	
Q5	Confounders identified	Q5	Confounders identified and methods (e.g. recruitment, statistics) were used to control for these.
Q6	Analysis does not appear to take confounders into account	Q6	
Q7	Used validated measures of burnout	Q7	Criterion validity measured/established for the measure of stress
Q8	Only description for analyses was ‘univariate analysis’	Q8	Statistics appear appropriate for data

Study: Nitszche (2017)[42]		**Study:** Ohlander (2015)[44]	
No.	**Additional comments**	**No.**	**Additional comments**
Q1	Inclusion criteria defined	Q1	Inclusion criteria defined
Q2	Subjects described in adequate detail	Q2	Subjects described in adequate detail
Q3	Study-specific single question on recovery opportunities with Likert-type rating. Not validated, not objective or standardised measure.	Q3	Breaks measured in minutes per day. Appears objective and reliable.
Q4		Q4	
Q5	Confounders identified in limitations	Q5	Confounders identified
Q6	While SEM and multivariate equations should account for confounders, it appears the author did not put these into the equation.	Q6	Statistics accounted for apriori confounders.
Q7	Burnout, work-home conflict and home-work conflict measured using established, validated and reliable measures	Q7	Work stress measured on validated effort-reward imbalnce questionnaire
Q8	Statistics appear appropriate for data	Q8	Statistics appear appropriate for data
Study: Winston (2008)[39]			
No.	**Additional comments**		
Q1	Inclusion criteria defined		
Q2	Subjects described in adequate detail		
Q3	Not clear how break prevalence was measured. Lack of breaks listed as an option on a checklist of barriers to healthy eating.		
Q4	Does not appear to be validated or objective.		
Q5	Confounders identified		
Q6	Variables that could affect healthy eating are descriptively measured but break-taking analyses do not appear to account for confounding factors		
Q7	Study specific questionnaire used to select perceived barriers		
Q8	Statistics appear appropriate for data		

Supplementary Table 3. Rationale for qualitative risk of bias assessments (JBI)

Study: Hall (2018)[51]		**Study:** Lemaire (2011)[49]	
No.	**Additional comments**	**No.**	**Additional comments**
Q1	Philosophical perspective and methodology congruent	Q1	Unknown - No statement about philosophical or theoretical perspective
Q2	Methodology and research objectives congruent	Q2	Methodology and research objectives congruent
Q3	Methodology and methods congruent	Q3	Methodology and methods congruent
Q4	Methodology and analysis congruent	Q4	Methodology and analysis congruent
Q5	Methodology and interpretation congruent	Q5	Methodology and interpretation congruent
Q6	Partially. Acknowledges “the first author’s realist epistemological approach”.	Q6	Acknowledges that interviewer was female internal medicine consultant, clinical professor, a colleague, and Vice Chair of Physician Wellness and Vitality
Q7	No mention of implications of above (Q6)	Q7	No mention of implications of above (Q6)
Q8	Voices of participants adequately represented	Q8	Voices of participants adequately represented
Q9	Ethical approval granted	Q9	Ethical approval granted
Q10	Conclusions appropriate	Q10	Conclusions appropriate
Study: Lockhart (2013)[50]		**Study:** Morrow (2014)[52]	
No.	**Additional comments**	**No.**	**Additional comments**
Q1	Unknown - No statement about philosophical or theoretical perspective	Q1	Unknown - No statement about philosophical or theoretical perspective
Q2	Methodology and research objectives congruent	Q2	Methodology and research objectives congruent
Q3	Methodology and methods congruent	Q3	Methodology and methods congruent
Q4	Methodology and analysis congruent	Q4	Methodology and analysis congruent
Q5	Methodology and interpretation congruent	Q5	Methodology and interpretation congruent
Q6	No statement about the researchers’ cultural or theoretical perspectives	Q6	No statement about the researchers’ cultural or theoretical perspectives

Q7	While an anonymous survey was used and researcher shouldn't theoretically have an influence, there were only 5 participants in the intervention so it is potentially more open to influence. Unclear from abstract information alone if this could affect results.	Q7	Influence of researcher not addressed
Q8	Unknown - Insufficient information in the abstract	Q8	Voices of participants adequately represented
Q9	Unknown - Insufficient information in the abstract	Q9	Ethical approval granted
Q10	Conclusions appropriate	Q10	Conclusions appropriate
Study: O'Shea (2020)[53]		**Study:** Walsh (2005)[54]	
No.	**Additional comments**	**No.**	**Additional comments**
Q1	Unknown - No statement about philosophical or theoretical perspective	Q1	Unknown - No statement about philosophical or theoretical perspective
Q2	Methodology and research objectives congruent	Q2	Methodology and research objectives congruent
Q3	Methodology and methods congruent	Q3	Methodology and methods congruent
Q4	Methodology and analysis congruent	Q4	Methodology and analysis congruent
Q5	Methodology and interpretation congruent	Q5	Methodology and interpretation congruent
Q6	No statement about the researchers' cultural or theoretical perspectives	Q6	No statement about the researchers' cultural or theoretical perspectives
Q7	Explains that faculty members known by participants were moderators for focus groups which could have influenced their answers	Q7	Influence of researcher not addressed
Q8	Voices of participants adequately represented	Q8	Voices of participants adequately represented
Q9	Ethical approval granted	Q9	Ethical approval granted
Q10	Conclusions appropriate	Q10	Conclusions appropriate
Study: Wilkesmann (2016)[55]			
No.	**Additional comments**		
Q1	Lots of theoretical context in the introduction (e.g. known unknowns, known knowns etc.) but no statement of philosophical perspective		
Q2	Methodology and research objectives congruent		

Q3	Methodology and methods congruent		
Q4	Methodology and analysis congruent		
Q5	Methodology and interpretation congruent		
Q6	No statement about the researchers' cultural or theoretical perspectives		
Q7	Influence of researcher not addressed		
Q8	While the qualitative data does show some evidence of quotes for the two overarching themes (hiding ignorance and sharing ignorance) there is not much evidence of participant voices in the hypotheses building		
Q9	Unknown – statement about ethical approvals not given		
Q10	Conclusions appropriate		

Supplementary Table 4: Summary of Included Studies

First author (year), Country, Publication Type	Design	Population	Break type and/or topic of investigation	Break-related outcome measurement(s)	Break-related result(s)
QUANTITATIVE STUDIES					
Standard 30-min break interventions					
Coburn (2006)[24] Germany Published report	Double blind randomised cross-over trial. Min. 28 days between phases	N=30 anaesthesia trainee doctors; 63.3% M	30-min breaks in a recreation room vs no break during 7.5 hr shifts	*Measured at 7:30 and 14:00:* 1) Test for Attentional Performance 2) Stanford Sleepiness Scale 3) State-Trait Anxiety Inventory	N.S difference between break or control on divided attention, working memory, sleepiness or self-reported anxiety
Mitra (2008) [25] Australia Published report	Before-and-after study over 4-week period (2-wk baseline phase, 2-wk intervention phase)	N=121 baseline and N=112 post-intervention surveys from ED doctors of all grades; M/F ratio not reported	Baseline/usual practice phase vs promotion of 30-min uninterrupted breaks (facilitated by cover doctor, educational sessions and posters)	*Completed at the end of every shift:* 1) Number of breaks and duration 2) Visual analogue tiredness rating 3) Fatigue Severity Scale 4) Routine departmental performance indicators	1) Break-taking improved from 33% to 60% 2) Subjective tiredness at end of shift lower when break taken (p<.001) 3) Reduction in objective fatigue levels at end of shift when break taken (p=.065) 4) Departmental performance indicators (e.g. triage time, time to be seen) improved (p<.001)
Sleep-related interventions					
Amin (2012) [26] USA Published report	Cluster non-randomised controlled trial. Single-day protocol. Intervention and control 1 yr apart	N=29 1st year medicine trainees; n=19 intervention, n=11 control; 58.6% M	20-min midday naps in a recliner chair during daytime shifts vs controls who lay in chair but conversed with researcher for 20 min	*Measured before and after intervention:* 1) Conner's Continuous Performance Test (CPTII) 2) Attentional failures (EEG) 3) Average sleep duration during intervention	1) Cognitive functioning improved in nap group compared with control (Hit reaction time p=.004; Omission rate p=.01; Commission rate p=.007) 2) Attentional failures decreased in nap group and increased in control group (p=.002) 3) 8.4 +/- 3 mins
Smith-Coggins (2006) [27] USA Published report	RCT. 2-day protocol: baseline shift and shift with intervention	N=49 ED staff (n=25 doctors, n=24 nurses); n=26 intervention, n=23 control; 32.7% M	40-min nap opportunity at 3AM during a 12-hr night shift vs continued work	*Measured before shift (BS-6:30pm), post-intervention (PI-4am) and after shift (AS-7:30am) on baseline and intervention day:* 1) Psychomotor Vigilance Task 2) Probe Recall Memory Task 3) IV simulation (CathSim)	1) No differences except AS-7:30am: Nap group had fewer lapses (p<.03) and faster reaction time (p<.05) 2) No differences except PI-4am when nap group worsened after nap (p<.05) 3) BS-6:30pm Control group quicker (p<.04), AS-7:30am nap group N.S. quicker (p=0.10)

First author (year), Country, Publication Type	Design	Population	Break type and/or topic of investigation	Break-related outcome measurement(s)	Break-related result(s)
				4) Profile of Mood States 5) Karolinska Sleepiness Scale 6) Driving simulation (StiSim Drive Simulation System) *Measured during nap (3am):* 7) Polysomnographic data	4) AS-7:30am nap group had less fatigue (p<.05) and more vigor (p<.03) 5) AS-7:30am Less sleepiness (p<.03) in nap group 6) Nap group improved dangerous driving and alertness from baseline, control group worsened from baseline (p<.03). No aggregate group differences on intervention day. 7) Average nap time: 24.8 mins (SD=11.1) Average sleep onset: 8.9 mins (SD=5.5)
Yoga and mindfulness interventions					
Babbar (2019) [29] USA Published report	Before-and-after study conducted over 8-week period	N=25 OBGYN trainee doctors and maternal-fetal medicine fellows; M/F ratio not reported	Weekly 1-hr yoga sessions held within protected education time	*Measured before and after 8-week intervention:* 1) Maslach Burnout Inventory 2) Depression Anxiety Stress Scale 3) Five Facet Mindfulness Questionnaire 4) Blood pressure (BP) 5) Heart rate 6) Average weight 7) Feedback survey on program	1) Reduction in depersonalization domain (p=.04). N.S. difference in other 2 domains. 2) Anxiety rates reduced (40% to 28%), stress rates reduced (40% to 24%), no difference in depression. 3) 1/5 domains increased (p=.01). N.S difference in total mindfulness. N.S difference between frequent and infrequent yoga attendees. 4) Systolic and diastolic BP decreased (p=.01). Greater decrease in frequent attendees (p=.04) 5) N.S difference. 6) Increased (p=.03). 7) 74% agreed protected wellness with colleagues improved training experience and felt more appreciated. 83% felt increased sense of camaraderie and more motivated to incorporate wellness in their lives. 90% became more aware of physical activity.
Babbar (2021) [28]* USA Published report *Note: Follow-up to Babbar 2019[23]	Before-and-after study conducted over 8-wk period	N=13 OBGYN trainee doctors and maternal-fetal medicine fellows; M/F ratio not reported	Weekly 1-hr yoga sessions held within protected education time	1) Daily objective sleep data (Polar A370 fitness tracker) 2) Baseline and post-intervention subjective sleep data (Pittsburgh Sleep Quality Index)	1) On yoga days, attendees had greater total (p = 0.04) and restful sleep (p=0.01) than non-attendees. Compared with non-yoga days, attendees had greater total (p=0.05) and restful sleep (p = 0.04) the night following yoga class. 2) N.S changes
Ireland (2017) [30] Australia Published report	RCT conducted over 10-week period	N=44 EM trainees n=23 intervention, n=21 control; 36% M	Wkly 1-hr mindfulness sessions for 10 wks vs 1-hr midday break per wk	*Measured at beginning (week1), middle (week 5), and end (week 10) of intervention:*	1) Intervention group stress decreased over time (p=.007, η^2=0.28). Control group stress N.S increased over time (p=0.302, η^2=0.08).

First author (year), Country, Publication Type	Design	Population	Break type and/or topic of investigation	Break-related outcome measurement(s)	Break-related result(s)
				1) Perceived Stress Scale 2) Copenhagen Burnout Inventory	2) Intervention group burnout N.S improved over time (p=.072, η^2=0.16); Control group burnout N.S. increased over time (p=0.222; η^2=0.10)
Scheid (2020) [31] USA Published report	Before-and-after study (6-wk intervention period)	N=12 faculty physicians; 0% M	Baseline/usual practice vs weekly 1-hr yoga sessions for 6 wks during work hrs	*Measured at baseline, post-intervention and 2 months post-intervention:* 1) Professional fulfilment and burnout (Professional Fulfilment Index); 2) Perceived Stress Scale 3) Resilience Scale; 4) Anxiety, depression and sleep disturbances (Patient-Reported Outcomes Measurement Information System) 5) Positive and Negative Affect Schedule; 6) Five Facet Mindfulness Questionnaire	*Between baseline and post-intervention:* Significant improvements in perceived stress (p=.031), anxiety (p=.045), depression (p=.029), resilience (p=.005), professional fulfilment (p=.031) and burnout (p=.047). N.S change in sleep disturbances, affect and mindfulness. *Between baseline and 2-month follow-up:* Significant improvement in 1 dimension of burnout (p=.038), resilience (p=.024), and mindfulness (p=.012. N.S change in professional fulfilment, overall burnout, perceived stress, anxiety, depression, sleep disturbances and affect.
Microbreak interventions in surgery					
Dorion (2013) [32] Canada Published report	Randomised crossover trial (N=16)	N=16 surgical staff and trainees; M/F ratio not reported	Control vs 20-second micropauses every 20 mins during prolonged (2 hr minimum) surgery	*Rated after control and intervention surgery:* 1) Study-specific rating of physical discomfort; 2) Fatigue (2.5kg weight hold for as long as possible) 3) Star-shaped precision test	1) Micropauses improved discomfort in neck, back, shoulders, wrists, elbows and eyes compared with control (p<.05). N.S difference in legs/lower limbs. 2) Micropauses improved muscular fatigue cf. control (p<.001). 3) Micropauses improved accuracy cf. control (p<0.01).
Engelmann (2011) [33] Germany Published report	Randomised crossover trial	N=7 paediatric surgeons; n=51 operations randomised to intervention (n=26) or control (n=25); 85.7% M	5-min intraoperative breaks every 30 mins (25-min work then 5-min break) vs control (no breaks)	*Measured before, during and/or after surgery:* 1) Salivary cortisol, amylase, testosterone, and DHEA; 2) BP-test of concentration and performance; 3) Fatigue items from NASA Task Load Index; 4) Perceived stress; 5) Pain (neck, arms, spine, knees, eyes); 6) Mean operation time corrected for complexity *Measured continuously:*	Compared with control group, break group showed: 1) Salivary cortisol improvement (p<.05), lower testosterone for female participant (p<.001), N.S difference in amylase and DHEA. 2) Improvement in attention (p<.05) and concentration (p=.06) – error rate 3x lower than control, threshold significance due to outlier. 3) Less post-operative fatigue (p<.005), less intra-operative impairment by fatigue (p<.001)

First author (year), Country, Publication Type	Design	Population	Break type and/or topic of investigation	Break-related outcome measurement(s)	Break-related result(s)
				7) Heart rate and intraoperative ECG events (sudden increase in HR during stressful event)	4) Less intra-operative stress (p<.05) 5) Less musculoskeletal strain (all p<.001 except eyes, p=.09) 6) No difference in mean operation time (breaks did not prolong operations, p>.05) 7) Fewer intraoperative events (p<.05), less increase in heart rate (p<.05)
Engelmann (2012) [34]* Germany Published report *Note: Follow-up to Engelmann 2011[33]. Includes patients as participants	RCT	N=7 paediatric surgeons and N=52 paediatric patients; surgeons 85.7% M	Patient outcomes and surgeon perceptions of 5-min intraoperative breaks every 30 mins (25-min work then 5-min break) vs control (no breaks)	*Patient outcomes measured during surgeries:* 1) Cardiovasular monitoring; 2) Urine volume; 3) Blood gas parameters; 4) Body temperature *Surgeon feedback measured 1 month after intervention:* 5) Team communication; 6) Team coordination; 7) Were there any welcome breaks vs any particularly unwelcome breaks?; 8) Overall scheme ratings; 9) Individual work style (fast, slow, exact, standardized, creative, alternating)	1-4) No difference between control and intervention groups in any patient outcomes. *Surgeon feedback:* 5) With breaks team communication changed from implicit (little verbal feedback) to explicit (outspoken) (p<.05) 6) More coordination required for break scheme but not significant (p>.05) 7) Unwelcome breaks scored N.S higher 8) Overall approval rating: 5.9/10 (+/- 3.2) 9) Slow operators more in favour of break scheme than fast operators (p<.05)
Hallbeck (2017) [35] USA Published report	Before-and-after study. 1 control day followed by 1 intervention day. Approx. 1 wk between control and intervention.	N=56 Consultant surgeons; 67.9% M	Control surgery day with no breaks vs one day of 1.5-2 min intraoperative microbreaks with guided exercises every 20-40 mins	*Measured pre- and post-surgery (control and intervention days):* 1) Surg-TLX and GOAL questionnaire; 2) Musculoskeletal pain (Adapted Nordic Musculoskeletal Questionnaire) *Measured after intervention:* 3) Physical performance; 4) Mental focus; 5) Distractions and workflow interruptions caused by breaks; 6) Desire to incorporate into routine	1) N.S difference in surgery duration, degree of difficulty, complexity, distractions, and mental and physical demands between intervention and control surgeries 2) Improvement in right and left shoulder pain (p<.001) with microbreaks compared with control 3) Improved by breaks: 62%; No change: 46% 4) Improved by breaks: 34%; No change: 53%; Reduced: 12% 5) Distractions: 2/10, Workflow interruptions: 2/10 6) 87% answered yes

First author (year), Country, Publication Type	Design	Population	Break type and/or topic of investigation	Break-related outcome measurement(s)	Break-related result(s)
Microbreak interventions - other					
Lemaire (2010) [36] Canada Published report	Before-and-after study. 2-day protocol	N=20 medical, surgical, and primary care staff physicians; n=17 day shifts, n=3 night shifts; 85% M	Standard/usual practice day vs one day of micro-food-breaks (delivery of 6 small daily meals) Baseline day preceded intervention day, both days occurred within 2 wk period	*Measured at baseline (7:30am) and 2-hourly intervals until end of day:* 1) Simple reaction time and complex reaction time (Brain Checkers software); 2) Capillary blood glucose samples (Precision Xtra Blood Glucose); 3) Volume of fluid consumed and urine voided; 4) Diet recall/food diaries; 5) Checklist of 17 hypoglycemic nutrition-related symptoms	1) Intervention improved speed and accuracy on simple reaction time test (p=0.01) and complex reaction time test (p<.001) 2) Blood glucose levels reduced on intervention day (p=0.03) and less variable 3) Fluid intake (p=.04) and urine output (p=.008) improved by intervention 4) Intervention increased caloric intake (p=.008) 5) N.S reduction in hypoglycemic nutrition-related symptoms on intervention day (p=0.36). 70% ppts reported fewer symptoms or no change compared with baseline
Mengin (2021) [37] France Published report	Randomised control trial	N=47 ENT trainee doctors; 47.7% M	Effect of listening to a 5-min guided mindfulness meditation vs control track prior to a simulated consultation where doctors break bad news to patients	Measured post-simulation only 1) Performance (rated by blinded expert assessors on bad-news consultation scale); 2) Physician self-rated empathy (visual analogue scale); 3) Patient perception of physician empathy (Jefferson Scale of Patient Perceptions of Physician Empathy) Measured pre-intervention, post-intervention and post-simulation 4) Self-rated stress (visual analogue scale); 5) Doctor self-rated confidence (visual analogue scale)	1) Performance improved in mindfulness group compared with control group (p=.026). Fewer participants rated as "fail" by assessors in the mindfulness group than control (4.3% vs 30.4%, p =.04) 2) N.S difference in self-rated empathy 3) N.S difference in patients' perceived empathy across groups. Perceived empathy positively correlated with performance (r=0.541, p<.001). 4) N.S difference in perceived stress 5) N.S difference in doctor confidence
Survey and cohort studies					
Al Dandan (2020) [38] Saudi Arabia Published report	Cross-sectional survey	N=198 clinical radiology trainees, and consultants; 56.1% M	Break-taking prevalence as a predictor of digital eye strain	1) Symptoms of digital eye strain 2) Break frequency (% of participants) 3) Break duration (% of participants)	1) Infrequent break-taking (once or twice per day) was a predictor of digital eye strain compared with more frequent break-taking 2) 25.3% once/day, 30.8% twice/day, 32.3% every 2 hours, 11.6% at least hourly 3) 10.6% <5 mins, 45.0% 5-10 mins, 28.3% 11-15 mins, 16.1% >15 mins

First author (year), Country, Publication Type	Design	Population	Break type and/or topic of investigation	Break-related outcome measurement(s)	Break-related result(s)
Winston (2008) [39] England, UK Published report	Cross-sectional survey	N=328 hospital doctors of varying grades; M/F ratio not reported	Break prevalence and healthy eating behaviours	1) Study-specific checklist of potential barriers to healthy eating 2) Break prevalence	1) Lack of breaks rated the most common barrier to healthy eating (66%). Next most common barriers: Lack of food choices (56%) and canteen opening times (48%). 2) Prevalence of regular break taking: 46%
Hassan (2020) [40] Egypt Published report	Cross-sectional survey	N=278 surgical and medical trainee doctors; 46.4% M	Association between break prevalence and level of work stress	Adapted version of the Hospital Consultants' Job Stress and Satisfaction Questionnaire (work characteristics rated for their contribution to work-related stress). Stress scores categorized as low, moderate and high.	High stress scores associated with lack of breaks during working hours (76.9% of low/moderate stress group not taking breaks vs 93.3% of high stress group not taking breaks, p=.001) Barriers to break taking: 50.7% of participants described rest areas as limited, 38.8% as sufficient for one person only, 1.8% as big enough, 8.7% reported no rest areas
Kirkcaldy (2002) [41] Germany Published report	Cross-sectional survey	N=309 doctors and consultants who own a medical practice; 63.4% M	Association between break duration and occupational stress, motor vehicle accident rates, and work-related accident rates	1) Study-specific questionnaire about occupational stress 2) Number of motor vehicle accidents 3) work-related accidents during previous 12 months 4) Break duration: Lunch break start and end time reported	1a) Occupational stress showed a significant negative association with lunch break duration (r=-0.19, p<.05) 1b) In predictor model of job stress break duration was significant (β=-0.16, p=.03) alongside 3 factors: weekly working hours, no. of dependent children and work satisfaction (R^2 adj = 0.12, p<.001) 2) Break duration not significant predictor of motor vehicle accident rates 3) In predictor model of work-related accidents, shorter lunch breaks were included (β=+.0.10, p<.10) alongside 1 factor: high levels of job commitment 4) Working longer hours significantly associated with shorter lunch breaks (p<.001)
Nitzsche (2017)[42] Germany Published report	Cross-sectional survey	N=152 private practice haematology and oncology physicians; 73% M	Association between breaks, emotional exhaustion and work-home conflict	1) Maslach Burnout Inventory (emotional exhaustion scale) 2) Work home conflict: Effect of work on private life (Survey Work-Home Interaction – NijmeGen)	1) Significant indirect effect of breaks on emotional exhaustion, mediated by work-home conflict (p<.05, β = -0.22). No direct effect. 2) Breaks directly related to work-home conflict. WHC reduced by breaks (β=-.33, p<.05).

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				3) Home-work conflict: Effect of private life on work 4) Two study specific questions about how often breaks are taken	3) No direct effect of breaks on home-work conflict. 4) 1/4 took regular breaks, 16% never took breaks.
Kalboussi (2020) [43] Tunisia Published report	Cross-sectional survey	N=46 anaesthetists of varying grades; 11% M	Association between taking breaks at work (among other occupational factors) and burnout	1) Maslach Burnout Inventory 2) Breaks at work dichotomised into "Yes" or "No"	N.S association between burnout and break-taking (p=0.790)
Ohlander (2015) [44] Sweden & Germany Published report	Cross-sectional survey Data from the 2nd of 3 follow-up surveys in cohort study.	Swedish sample: N=85 physicians; 60% M. German sample: N=561 physicians; 48.5% M	Association between break duration and work stress in two different countries	1) Work stress (Effort-Reward Imbalance questionnaire) 2) Minutes of break per day	1a) Sweden: Negative association between work stress and break duration (β=-0.002, p=.03) 1b) Germany: N.S. association, break duration not included in regression model 2) German sample had shorter breaks per day than Swedish sample (28.2 +/- 18.1 min/day vs 40.4 +/- 20.9 min/day)
Berastegui (2020) [45] Belgium Published report	Observational prospective longitudinal study conducted over 10-month period	N=28 ED doctors; 60.7% M	Association between fatigue reduction strategies with a) reaction time, and b) burnout. Fatigue reduction strategies: Used to reduce subjective on-the-job fatigue e.g. rest, nap, have a snack, get fresh air, listen to music, etc.	*Measured at baseline only:* 1) Checklist of fatigue reduction strategies (FRS, checklist based on previous focus group data) 2) Maslach Burnout Inventory measured at baseline only *Measured during each shift (6:30-7:30pm for day shift, 9:30-11pm for night shift):* 3) Psychomotor Vigilance Task (PVT)	1) Higher FRS use significantly associated with faster reaction times on PVT (p=0.01) 2) FRS use not significantly associated with burnout
Hockey (2020) [46] England, UK Published report	Observational prospective longitudinal study	N=565 trainee doctors; 42% M	Association between breaks and positive and negative affect	*Tasks and affect measured during 2-hour windows. Repeated 5 times in different shifts.* Intensity of positive affect (competence, enjoyment, friendliness, happiness) and negative affect (worry, tiredness, impatience, hassle, frustration, criticism) when reporting a break	Compared to shifts with breaks, in shifts without breaks participants experienced significantly greater feelings of negative affect and significantly less feelings of positive affect on all measured domains.

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Neprash (2018)[47] USA Conference presentation* *Report published did not include break data.	Retrospective cohort study (Secondary analysis of electronic records spanning 2013-2014 period)	N=2,805 primary care doctors (n=703,612 appointments); M/F ratio not reported	Opioid, NSAID and physical therapy prescribing rates immediately before and after breaks of >15 mins (during appointments where opioids were likely inappropriate)	1) Opioid, NSAID and physical therapy prescribing rates for outpatient appointments (per electronic health record systems) 2) Breaks: Gap of >15 mins in schedule	Doctors 4.9% more likely to inappropriately prescribe opioids before breaks than after (p=0.02) N.S. relationship with physical therapy orders and NSAID prescribing
Vosshenrich (2021)[48] Switzerland Published report	Retrospective cohort study (secondary data analysis of trainee doctors' reports)	*N*=117,402 reports written by *n*=27 trainee doctors; M/F ratio not reported	Effect of lunch breaks on number of corrections made to trainee doctor's reports in proofreading process	Similarity (%) of preliminary reports to final corrected versions (Jaccard similarity coefficient)	Report similarity temporarily increased after breaks (lunchtime), suggesting recovery. However, recovery effect reduced as the week progressed and disappeared towards end of the week.
QUALITATIVE STUDIES					
Qualitative appraisals of interventions					
Lemaire (2011)[49]* Canada Published report *Note: qualitative follow-up to Lemaire 2010 quantitative intervention study[36]	Before-and-after study evaluation using semi-structured interviews	N=20 medical, surgical, and primary care physicians; 85% M	Standard/usual practice day vs one day of micro-food-breaks (delivery of 6 small daily meals) Baseline day preceded intervention day, both days occurred within a 2-week period	Semi-structured interviews before and after intervention (15-45 min duration) analysed inductively by 2 coders	Impact of inadequate nutrition: 1) Emotional symptoms (e.g. irritability); 2) Physical symptoms (e.g. inability to focus or concentrate); 3) Affects ability to work (efficiency, focus); 4) Affects interactions with others (colleagues and patients). Barriers to adequate nutrition: 1) Lack of time due to workload and schedule; 2) Lack of access to nutrition (distance of facilities, queues, opening hours); 3) Lack of food choices; 4) Work ethic (work/patients come first); 5) Professionalism (unprofessional to eat in patient areas). Impact of participating in the intervention: 1) Increased awareness of workplace nutrition and impact; 2) Intention to change future habits and eat more regularly.

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Lockhart (2013) [50] Canada Conference abstract	One-group post-test only design using qualitative survey evaluation	N=5 rheumatology senior trainees; M/F ratio not reported	1-hour circuit-training-style exercise session for 12-week period instead of lecture as part of academic half-day	Qualitative survey administered in week 9 of 12	1) Program resulted in changes to diet, stress, sleep habits, mood, learning and time-off activities; 2) Participants perceived program as effective use of time and resources, preferable over teachings; 3) 4/5 participants desired focused instruction on beneficial exercises for patients; 4) 3/5 confidence in exercise prescribing increased; 5) 5/5 participants perceived work and training as barrier to exercise; 6) 3/5 had not previously participated in regular exercise. 2/5 participated twice wkly. Post-intervention 4/5 complete 1-3 sessions of exercise >30 mins.
Other qualitative studies					
Hall (2018) [51] England, UK Published report	Single occasion focus groups	N=25 General practitioners (locums, salaried, trainees, and partners); n=5 focus groups; 44% M	Breaks as potential strategy to improve general practitioner wellbeing	Inductive thematic analysis (2 coders)	Breaks: 1) Scheduled short breaks as feasible strategy to improve wellbeing. Lunch breaks not deemed realistic but short coffee breaks feasible; 2) Breaks as opportunity to leave the work space, interact with colleagues, and/or have respite from work; 3) Breaks valued where they are common practice and desired where they are not; 4) Increase in resources perceived as fundamental to enabling time for breaks
Morrow (2014) [52] UK (England, Scotland Wales, Northern Ireland) Published report	Focus groups and telephone interviews	N=82 medical, surgical and psychiatry trainee doctors; 44% M	Effect of UK Working Time Regulations (WTR) on trainees' experience of fatigue (including effect on breaks and rest periods)	n=11 focus groups (60-90 mins) and n=30 telephone interviews (30-45 mins) for participants who could not attend focus groups Analysed using a framework approach (2 coders)	WTR implementation in practice: 1) Fatigue still experienced despite regulations (e.g. due to work compression and intensity); 2) Rest facilities being reduced and less capacity to take breaks or rest; 3) Lost rest periods due to senior staff lack of awareness of them. Effects of fatigue: 1) Detriment to skills, judgement, efficiency, mood, ability to retain new information; 2) Effects compounded by hunger/discomfort from inability to take breaks
O'Shea (2020) [53] USA Published report	Focus groups	*N*=116 EM doctors (all grades); M/F ratio not reported	Beliefs about taking breaks for self-care while on shift	*n*=8 one-hour focus groups conducted separately with trainees and consultant doctors. Analysed for	Six themes: 1) ED Doctors have innate physiological needs which affect cognitive function and emotional regulation; 2) Shared beliefs (culture) on break-

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				themes by 3 coders and validated by participants.	taking relate to productivity and patient safety as a strength, and self-care as a weakness; 3) Breaks can create delays and negatively impact patient safety, though no participants had experienced this personally; 4) The ability to take breaks requires certain skills, safety-oriented communication strategies, and practice; 5) Changing the cultural norms would require approval from peers and other staff; 6) Breaks need to be flexible in form and duration and cater to individual needs and circumstances.
Walsh (2005) [54] Canada Published report	Semi-structured individual interviews	N=21 female family medicine trainee doctors; 0% M	Effect of access to breaks on ability to breastfeed when returning to work from maternity leave	Semi-structured individual interviews analysed for themes	1) Breastfeeding valued but often unable to continue at work. 2) Maintaining breastfeeding contingent on ability to take breaks to express breast milk. Additional requirements: privacy, good breast pump, refrigerated storage and sympathetic seniors.
MIXED METHOD STUDIES					
Wilkesmann (2016)[55] Germany Published report	Sequential mixed method design	N=43 qualitative semi-structured interviews with hospital physicians; N=2,598 quantitative surveys from surgeons and anaesthetists (trainee doctors excluded); M/F ratio not reported	Impact of breaks on opportunities for physicians to 'share ignorance' (detect unknown things and share them, ability to learn from failures) or 'hide ignorance' (intentionally prevent knowledge sharing) Ignorance: a known or unknown lack of knowledge	1) Qualitative semi-structured interviews analysed using content analysis firstly deductively then inductively to form hypotheses for subsequent testing in the quantitative survey 2) Quantitative survey item: Effect of breaks ("I usually take opportunities to discuss work related things in my work break with colleagues") on a) hiding ignorance and b) sharing ignorance	1) <u>Qualitative findings:</u> Breaks could serve as informal, face-to-face opportunity to share ignorance and learn from it 2) <u>Quantitative findings:</u> a) Breaks had N.S. effect on hiding ignorance (p=0.64) b) Breaks had a significant effect on sharing ignorance (p<.001)

Legend and Abbreviations: 'Trainees' – includes any/all grades unless specifically stated. Consultants – fully trained in specialty, includes 'attending physicians/ surgeons'. EM – Emergency Medicine specialty. ED – Emergency department. OBGYN – Obstetrics and Gynaecology. ENT- Ear, Nose and Throat. NSAIDS – non-steroidal anti-inflammatory medication. WTR – working time regulations. UK- United Kingdom. RCT- Randomised control trial