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BMJ Open

Need for recovery amongst Emergency Physicians in the United Kingdom and Ireland: a cross-sectional survey

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1 **Need for recovery amongst Emergency Physicians in the United**
2 **Kingdom and Ireland: a cross-sectional survey**

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65 **Keywords:** Emergency Medicine; Human resource management;

66 Organisation of health services; Occupational and Industrial medicine.

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1
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3 **68 ABSTRACT**
4

5 **69 Objectives:** To determine the need for recovery (NFR) among Emergency
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7
8 **70 Physicians** and to identify demographic and occupational characteristics
9
10 associated with higher NFR scores.
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12 **72 Design:** Cross-sectional electronic survey.
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14 **73 Setting:** Emergency Departments (n=112) in the United Kingdom and Ireland.
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16 **74 Participants:** Emergency Physicians (n=4247) responding over a six-week
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20 period in June-July 2019.
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22 **76 Main outcome measure:** NFR score.
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24 **77 Results:** The median NFR score for all 4247 eligible and consented
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89 **Conclusion:** Higher NFR scores were observed among Emergency
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93 with increasing NFR score. Future strategies to reduce fatigue and improve
94 physician wellbeing / staff retention should target these modifiable
95 characteristics.

For peer review only

1
2
3 96 **ARTICLE SUMMARY**

4
5 97
6 98 **Strengths and limitations of this study**

- 7 99
8 100
9 101 • This is the first study evaluating the need for recovery (NFR) scale within a
10
11 large healthcare population.
12 102
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14 103
15
16 104 • The inclusion of responses from over half of all UK Emergency
17
18 Departments indicates the results are likely to be generalisable.
19 105
20
21 106
22
23 107 • The high volume of responses, with over half of study sites exceeding 70%
24
25 participant response rates, indicates that the NFR scale is an acceptable
26 108
27 measurement tool for physicians.
28 109
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30 110
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32 111 • The study is limited by the single-point of time measurement therefore
33
34 seasonal bias cannot be excluded and further assessment of test-retest
35 112
36 reliability is desirable.
37 113
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41 115 • The use of self-administered dichotomous questionnaires is acknowledged
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43 to limit wider insights into physician recovery and well-being.
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117 INTRODUCTION

118 Recruitment and retention challenges in acute care pose a significant and
119 ongoing threat to effective healthcare provision. The need to maintain a healthy
120 and sustainable workforce is vital to safeguard future services.[1] Physician
121 well-being is a key influence on retention, with low job satisfaction and high
122 levels of stress directly leading to concern over job sustainability.[2–4] Globally,
123 high rates of physician burnout are increasingly recognised, along with the
124 consequent negative impact on delivery of high quality patient care.[5–10]
125 Within unscheduled care settings such as emergency medicine, high intensity
126 shift work is likely to further exacerbate impaired personal well-being. Where
127 fatigue cannot be sufficiently recovered between shifts, the effect is cumulative
128 and may lead to increased occupational stress and impaired long-term
129 health.[11,12]

130 Attempts to quantify and measure well-being amongst healthcare staff
131 have led to an increasing prevalence of burnout inventories.[13] Whilst these
132 may provide an overview at an organisational level, they often lack the ability
133 to define specific contributory factors or highlight opportunities for
134 intervention.[14] Furthermore, these inventories quantify established burnout.
135 Once this has occurred, the human and financial resource impact is already
136 immense, with associated workforce depletion and limited mitigation
137 strategies.[15,16]

138 The identification of those at risk, at an early timepoint when
139 interventions may be effective, presents a critical challenge. The Need for
140 Recovery (NFR) scale measures the subjective perception of the need to
141 recuperate from physical and mental demands of a working day, and is a

1
2
3 142 suitable tool with which to assess shift workers.[17,18] Increasing NFR is
4
5 143 associated with likelihood of progression to occupational burnout and health
6
7 144 complaints, with negative effects cumulative over time in several validation
8
9 145 studies.[11,17]
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11

12 146 Staff well-being is the fourth highest Emergency Medicine Research
13
14 147 Priority identified by the James Lind Alliance Priority Setting Partnership,
15
16 148 involving patients, carers and physicians.[19] This priority is related to
17
18 149 identification of initiatives to improve Emergency Department (ED) staff
19
20 150 engagement, resilience, retention, satisfaction, individuality and responsibility.
21
22 151 We therefore aimed to determine the NFR among Emergency Physicians in
23
24 152 EDs in the UK and Ireland, and identify demographic and occupational
25
26 153 characteristics associated with higher NFR scores that might allow for early
27
28 154 targeted intervention to improve physicians' well-being and reduce burnout.
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33 155

35 156 **METHODS**

37 157 This cross-sectional electronic survey study targeted a representative sample
38
39 158 of Emergency Physicians working across the UK and Ireland, and was
40
41 159 performed and reported in line with the Checklist for Reporting Results of
42
43 160 Internet E-surveys.[20] The study was registered at ISRCTN
44
45 161 (<https://doi.org/10.1186/ISRCTN21869845>). Ethical approval was obtained
46
47 162 from the UK Health Research Authority (Reference: 19/HRA/2404) alongside
48
49 163 equivalent approvals in Scotland, Northern Ireland and Ireland.
50
51

53 164 **Settings and Participants**

54
55 165 An initial sample of 100 EDs was deemed necessary to ensure inclusion of
56
57 166 greater than 50% of Type 1 EDs, defined as 'a consultant led 24-hour service
58
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1
2
3 167 with full resuscitation facilities', in England. [21] The study was coordinated via
4
5 168 the UK Trainee Emergency Research Network (TERN) and delivered in
6
7 169 collaboration with Paediatric Emergency Research in the UK and Ireland
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9
10 170 (PERUKI) and Ireland TERN. [22, 23] Signposting to the survey and enrolment
11
12 171 of participants was led by site principal investigators (PI), who were provided
13
14 172 with standardised study documentation. Local and national promotion of the
15
16 173 study was conducted at professional meetings, through social media, national
17
18 174 newsletters, and using the Clinical Research Network infrastructure.

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21 175 Physicians of any grade who were registered with either the UK General
22
23 176 Medical Council or Irish Medical Council, and who were employed within a
24
25 177 participating ED, were invited to participate. The term Emergency Physician
26
27 178 was defined as doctors specialising in Emergency Medicine (EM), or non-EM
28
29 179 specialists undertaking rotations in the ED as part of their professional training.
30
31 180 Physicians who did not hold a permanent contract with a participating hospital
32
33 181 (such as those working ad-hoc locum shifts), those on leave during the study
34
35 182 period, and those in a non-clinical role were excluded.

36 37 38 39 183 **Survey Development**

40
41
42 184 The NFR scale consists of 11 items each requiring a dichotomous 'yes' or 'no'
43
44 185 response, originally developed as a subscale of the Dutch Questionnaire on the
45
46 186 Experience and Evaluation of Work (QEEW).[24] The NFR has previously been
47
48 187 demonstrated to have an overall Cronbach's alpha of 0.88, a measure of
49
50 188 internal consistency and questionnaire reliability, with a range of 0.81 to 0.92 in
51
52 189 subgroup analyses of the same validation study.[25] Following a minor
53
54 190 amendment to one question to increase applicability to the study population
55
56 191 (from 'After the evening meal, I generally feel in good shape' to 'After my breaks
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1
2
3 192 I feel fresh to continue my work'), feasibility work in a single UK centre
4
5 193 demonstrated a Cronbach's alpha of 0.79, and found that the NFR scale was
6
7 194 acceptable and user-friendly. [26]
8
9

10 195 A patient and public involvement (PPI) consultation was conducted at
11
12 196 the UK Emergency Medicine Trainee Association Conference (Cardiff,
13
14 197 December 2018), using a semi-structured question guide for mixed focus
15
16 198 groups to review a proposed participant survey. Based on this consultation, the
17
18 199 final participant survey included the 11-item NFR scale used in the feasibility
19
20 200 work and 44-items collecting the participants' demographic, occupational and
21
22 201 perceived well-being characteristics (Online Supplementary Material 1).
23
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26 202 A separate site-specific survey was developed de novo with expert input
27
28 203 from experienced EM physicians, consisting of 39-items identified from the
29
30 204 literature and/or consensus of the study team, which explored departmental,
31
32 205 rota pattern and staffing characteristics likely to provide context for analysis and
33
34 206 interpretation of individual survey results (Online Supplementary Material 2).
35
36 207 Only one site-specific survey was required per participating centre and was
37
38 208 completed by the site PI.
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42 209 **Survey Distribution, monitoring and recruitment**

43

44 210 All participants were provided with an information sheet, and consented to
45
46 211 participation prior to completing the survey; this was voluntary, anonymous, and
47
48 212 no incentives were given. Respondents were able to review and change their
49
50 213 answers prior to final submission of the survey. Branching logic was used for
51
52 214 responses to certain questions. Data were collected during a six-week period
53
54 215 from 3rd June 2019. The participant and site-specific surveys were open
55
56 216 surveys accessed through a link and hosted on a research specific electronic
57
58
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2
3 217 survey platform, Research Electronic Data Capture platform ('REDCap';
4
5 218 University of Bristol), which complies with European General Data Protection
6
7
8 219 Regulations.[27,28]
9

10 220 Prior to study commencement, site PIs provided a best estimate of
11
12 221 eligible participants which accounted for local physician absence due to
13
14 222 sickness, leave, and factors such as sabbaticals and professional
15
16
17 223 secondments. This denominator was used to give a best-estimate of the per-
18
19 224 site survey response rate, with a stated aim of achieving a 70% response rate.
20

21 225 **Statistical Analysis**

22
23
24 226 Statistical analysis was undertaken using STATA 14. [29] Participants were
25
26 227 only included in any of the reported analyses if they were from one of the 112
27
28 228 registered sites and provided a response for at least eight of the 11 items of the
29
30 229 NFR scale as per imputation guidelines. Imputation was performed by replacing
31
32
33 230 missing items with the mean of all completed items responses. [30]
34

35 231 As one item in the NFR scale was amended due to applicability to the
36
37 232 study population, the internal consistency of the NFR scale for all participants
38
39 233 with a valid NFR score was calculated by Cronbach's alpha.
40

41
42 234 To describe the study sample the frequency and percentage of
43
44 235 participants by site, demographic and occupational characteristics is reported.
45
46
47 236 As the distribution of the NFR score in this study was negatively skewed,
48
49 237 summary statistics of the median NFR score are reported with corresponding
50
51 238 bootstrapped 95% confidence intervals from 1000 replications (providing there
52
53
54 239 are at least 8 observations to allow for sufficient number of sample
55
56 240 combinations), and inter-quartile ranges (IQR) of all eligible participants. Box
57
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241 plots were used as visual aids to identify covariates that may have a statistically
 242 significant association with the NFR score and the nature of the relationship.

243 To facilitate comparisons with previous published literature and given
 244 the large number of participants, we fitted Gaussian, mixed effects, linear
 245 regression models to NFR score, where site was included as a random effect
 246 to account for potentially unknown differences between different EDs. To
 247 identify statistically significant associations between the NFR score and
 248 observed covariates, the forward model selection procedure was implemented;
 249 inclusion in the model was based upon the goodness of fit test at the 5% level
 250 of significance, using only participants with complete NFR score and covariate
 251 data. The final model was estimated using participants with complete data for
 252 the included covariates and NFR score. Quantile regression was used to
 253 confirm the direction and significance of the identified associations under non-
 254 parametric assumptions.

256 RESULTS

257 Characteristics of the 112 participating sites are presented in table 1.

258 **Table 1: Characteristics of sites registered to take part in the survey study**

Site Characteristics	N (%) Total = 112
Country	
England	89 (79.5)
Wales	3 (2.7)
Northern Ireland	3 (2.7)
Scotland	12 (10.7)
Republic of Ireland	5 (4.4)
ED Annual Attendance	

≤ 50,000	11 (9.8)
50,001 to 100,000	46 (41.1)
>100,000	42 (37.5)
<i>Missing</i>	13 (11.6)
Specialist Designation	
Trauma Unit	55 (49.1)
Major Trauma Centre	25 (22.3)
Stroke Centre	42 (37.5)
PCI Centre	30 (26.8)

259

260

ED Emergency department

261

PCI Percutaneous Coronary Intervention

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264

Of 5107 unique visits to the online survey, 4365 of these were registered at one

265

of the 112 sites and provided consent, with 4247 completing at least 8 items of

266

the NFR scale. Cronbach's alpha for all participants with a valid NFR score was

267

0.80. The median NFR score across all eligible participants was 70.0 (95% CI:

268

65.5 to 74.5), with an IQR of 45.5 – 90.0. Figure 1 and Figure 2, and tables 2

269

and 3 present a selection of participant's NFR score by demographic and

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occupational characteristics, with additional characteristics presented in the

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Online Supplementary Material 3.

272

273

Table 2: Summary statistics of NFR score by participant's characteristics. Frequency and percentage, median Need for Recovery (NFR) score with 95% bootstrapped confidence intervals and the inter-quartile range of participants within each category.

274

Participant Characteristics	N (%)	NFR Score	
		Median (95% CI)	[LQ - UQ]
All participants	4247 (100)	70.0 (62.0 to 78.0)	[45.5 - 90.0]
Length of time worked in current ED (months)			
0 to 3	740 (17.5)	72.7 (71.7 to 73.8)	[45.5 - 90.9]
> 3 to 6	848 (20.0)	72.7 (72.7 to 72.7)	[54.5 - 90.9]
> 6 to 12	729 (17.2)	72.7 (64.7 to 80.7)	[45.5 - 90.9]
> 12 to 24	370 (8.7)	63.6 (58.8 to 68.4)	[45.5 - 90.9]
> 24 to 60	583 (13.8)	63.6 (62.2 to 65.1)	[36.4 - 81.8]

> 60 to 120	497 (11.7)	63.6 (56.7 to 70.5)	[36.4 - 81.8]
> 120	473 (11.2)	54.5 (46.6 to 62.5)	[36.4 - 81.8]
Missing	7 (0.2)	18.2 (NA) ¹	[9.1 - 54.5]
Type of contract			
100%	3445 (83.5)	72.7 (67.1 to 78.4)	[45.5 - 90.9]
90%	72 (1.7)	63.6 (54.0 to 73.3)	[36.4 - 81.8]
80%	200 (4.8)	63.6 (61.4 to 65.8)	[45.5 - 81.8]
70%	116 (2.8)	72.7 (63.6 to 81.9)	[50.0 - 81.8]
60%	142 (3.4)	63.6 (54.4 to 72.9)	[45.5 - 90.9]
50%	85 (2.1)	63.6 (53.5 to 73.7)	[36.4 - 81.8]
< 50%	66 (1.6)	50.0 (35.7 to 64.3)	[27.3 - 81.8]
Missing	121 (2.9)	72.7 (67.8 to 77.7)	[54.5 - 90.9]
Significant caring responsibilities outside of work			
No	2616 (63.6)	72.7 (68.5 to 77.0)	[45.5 - 90.9]
Yes	1427 (34.7)	63.6 (62.8 to 64.5)	[36.4 - 81.8]
Prefer not to say	73 (1.8)	81.8 (71.0 to 92.7)	[54.5 - 90.9]
Missing	131 (3.2)	72.7 (68.2 to 77.3)	[54.5 - 90.9]

275 ¹ Insufficient observations for Bootstrapped 95% confidence intervals based

276 ST1-ST2 Specialist training year 1-2 (this included physicians training in Anaesthetics, Emergency
277 Medicine, Acute Medicine and General Practice)

278 SASG Staff grade, associate specialist and speciality grade

279 GP General Practitioner working within the ED

280
281

282 **Table 3: Summary statistics of NFR score by occupational characteristics.** Frequency
283 and percentage, median Need for Recovery (NFR) score with 95% bootstrapped confidence
284 intervals and the inter-quartile range of participants within each category.

Occupational Characteristics	N (%)	NFR Score	
		Median (95% CI) ¹	[LQ - UQ]
All participants	4247 (100)	70.0 (62.0 to 78.0)	[45.5 - 90.0]
scheduled weekend work frequency			
1 in 2	1479 (36.0)	72.7 (72.3 to 73.2)	[54.5 - 90.9]
1 in 3	865 (21.1)	72.7 (68.1 to 77.4)	[45.5 - 90.9]
1 in 4	542 (13.2)	63.6 (57.1 to 70.2)	[45.5 - 81.8]
1 in 5	310 (7.5)	54.5 (48.4 to 60.7)	[36.4 - 81.8]
1 in 6	485 (11.8)	54.5 (49.8 to 59.3)	[27.3 - 81.8]
< 1 in 6	307 (7.5)	63.6 (55.2 to 72.1)	[36.4 - 81.8]
None	121 (2.9)	54.5 (45.7 to 63.4)	[27.3 - 81.8]
Missing	138 (3.4)	72.7 (65.9 to 79.6)	[45.5 - 90.9]
Maximum number of consecutive clinical shifts scheduled to work			
1	52 (1.3)	63.6 (45.1 to 82.2)	[27.3 - 90.9]
2	190 (4.6)	54.5 (47.6 to 61.5)	[27.3 - 72.7]
3	465 (11.3)	63.6 (60.3 to 67.0)	[36.4 - 81.8]
4	783 (19)	63.6 (63.0 to 64.3)	[45.5 - 81.8]
5	827 (20.1)	72.7 (66.2 to 79.3)	[45.5 - 81.8]

6	389 (9.5)	72.7 (67.3 to 78.2)	[45.5 - 90.0]
7	855 (20.8)	72.7 (70.8 to 74.6)	[45.5 - 90.9]
8	554 (13.5)	72.7 (66.5 to 78.9)	[54.5 - 90.9]
Missing	132 (3.2)	72.7 (67.9 to 77.6)	[54.5 - 90.9]

285 ¹ Bootstrapped 95% confidence intervals based on 1000 replications on a minimum of 8
 286 observations.
 287

288 Only 7.5% of the participants were aged over 50 years, and the majority
 289 were aged between 26 and 30 years (28.6%). NFR score appeared to decrease
 290 with age, such that those in age groups 20 to 35 years all had a median score
 291 of 72.7, age groups 36 to 55 had a median score of 63.6, and those over 55
 292 years had a median score of 54.5 (figure 1a). There was a reasonable balance
 293 between males and females, with just over 1% who did not submit a response
 294 (missing), preferred not to say or other. The evidence suggested that females
 295 had a higher median NFR score of 72.7 (95% CI: 70.5 to 75.0) compared with
 296 males 63.6 (95% CI: 60.8 to 66.5) (figure 1b). Within clinical grade, consultants
 297 accounted for over a quarter of the participants who (with GPs) had the lowest
 298 median NFR score of 54.5 (consultants 95% CI: 53.6 to 55.5) compared with
 299 72.7 in all other grades (figure 1c). The majority of participants had no long-
 300 term health conditions or disability (88.6%), with a lower NFR score of 63.6
 301 (95% CI 60.2 to 67.1) compared with those who did report a long-term health
 302 condition or disability 72.7 (95% CI: 66.2 to 79.2) (figure 1d). Most participants
 303 worked full time (83.5%), but overall, the NFR score did not decrease as
 304 contract proportion decreased (table 2). Over half (54.6%) had been working in
 305 their current ED for 1 year or less and generally had higher NFR scores
 306 compared to those present for over 1 year. Less than 35% of participants
 307 declared significant caring responsibilities outside of work, but those who do
 308 had a lower median NFR score (63.6, 95% CI: 62.8 to 64.5) than those who did
 309 not (72.7, 95% CI: 68.5 to 77.0).

310 Most of the participants agreed or strongly agreed they were able to
 311 obtain study (68%) or annual (>73%) leave when requested. As the ability to
 312 obtain study and annual leave on request increased, the NFR score decreased
 313 from 81.8 (95% CI: 81.4 to 82.2) to 54.5 (95% CI: 49.4 to 59.7) for study leave
 314 and 81.8 (95% CI: 76.4 to 87.2) to 60.0 (95% CI: 51.8 to 68.2) for annual leave
 315 (figures 2a and 2b). There was evidence the NFR score increased as the
 316 proportion of time working out of hours increased, from 54.5 (95% CI: 47.8 to
 317 61.3) to 81.8 (95% CI: 75.4 to 88.3) (figure 2c). Over 75% of participants spent
 318 the majority of their time in adult EM with a median NFR score of 72.7 for mixed
 319 or adult only, which was higher when compared with paediatrics only 63.6 (95%
 320 CI: 55.2 to 72.1) (figure 2d). Most participants worked 1 in 2 weekends (36%)
 321 with a median NFR score of 72.7, which decreased to 54.5 for those who did
 322 not work any weekend shifts (see table 3). Over 50% reported working 5 to 8
 323 consecutive clinical shifts with a median NFR score of 72.7 compared with
 324 those who worked less than five, with a median NFR \leq 63.6.

325 The summary statistics of the final regression model are presented in
 326 table 4.

327 **Table 4: Summary of final Gaussian, mixed effects, linear regression model fitted to the**
 328 **Need for Recovery (NFR) score, including the adjusted coefficient estimate (Adj. Coef.**
 329 **Est.) with corresponding 95% confidence interval (CI) and p-value.**

	Adj. Coeff. Est. (95% CI)	P-value ¹
Constant (baseline NFR score)	59.51(55.53 to 63.49)	< 0.001
Gender (baseline = Male)		
• Female	3.40(1.80 to 4.99)	< 0.001
• Other/Prefer not to say	-0.46(-9.07 to 8.15)	0.916
Any long-term health conditions or disabilities (baseline = No)		
• Yes	8.52(5.67 to 11.36)	< 0.001
• Prefer not to say	6.24(1.52 to 10.95)	0.01

ED paediatrics only? (baseline = No)		
• Yes	-7.08(-10.4 to -3.77)	< 0.001
Clinical grade (baseline = Foundation)		
• ST1-ST2	-0.08(-2.67 to 2.51)	0.953
• > ST2	1.32(-1.37 to 4.01)	0.336
• SASG	-1.13(-4.27 to 2.02)	0.482
• GP	-8.26(-15.09 to -1.44)	0.018
• Consultant	-5.30(-8.07 to -2.53)	< 0.001
I have been able to request and take study when I wanted (baseline = Neutral)		
• Strongly disagree	4.23(-0.26 to 8.71)	0.065
• Disagree	3.72(0.29 to 7.15)	0.034
• Agree	-1.32(-3.60 to 0.96)	0.257
• Strongly agree	-6.50(-9.43 to -3.56)	< 0.001
I have been able to request and take annual when I wanted (baseline = Neutral)		
• Strongly disagree	6.43(2.03 to 10.83)	0.004
• Disagree	1.13(-2.34 to 4.61)	0.523
• Agree	-2.84(-5.54 to -0.14)	0.039
• Strongly agree	-4.89(-8.06 to -1.72)	0.002
Proportion of time spent working out of hours (baseline = 0-25%)		
• 26-50%	5.74(3.13 to 8.35)	< 0.001
• 51-75%	10.32(7.60 to 13.03)	< 0.001
• 76-100%	14.45(10.97 to 17.92)	< 0.001

¹ Null hypothesis: Adjusted Coefficient Estimate = 0 (i.e. is there statistically significant evidence this category differs from the baseline category)

332

333 This model was based on 3979 participants with complete data for all the
 334 included covariates. Quantile regression confirmed the direction and
 335 significance of the associations remained the same (Online Supplementary
 336 Material 4). The results from this model indicated there were statistically
 337 significant associations between gender, health conditions, type of ED (adult
 338 or paediatric), clinical grade, access to annual and study leave, and time
 339 spent working out of hours. The model suggested that males, GPs or
 340 consultants, those working in paediatrics and those with no long-term health
 341 condition or disability had the lowest NFR score. The greatest increase in

1
2
3 342 NFR score was associated with those who reported more than a 75%
4
5 343 proportion of out of hours work (14.45: 95% CI 10.97 to 17.92). If participants
6
7 344 strongly agreed they were able to obtain study leave upon request this
8
9 345 reduced their NFR score by 6.5 (95% CI: 3.56 to 9.43) and annual leave could
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11 346 reduce their NFR score 4.89 (95% CI 1.72 to 8.06).
12
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15 347

17 348 **DISCUSSION**

19 349 Emergency Physicians in the UK and Ireland have a higher NFR score than
20
21 350 has been reported in any previously studied population.[17,31–35] Three
22
23 351 modifiable occupational factors were significantly associated with higher NFR
24
25 352 scores (poor access to annual leave, and study leave, and proportion of out of
26
27 353 hours work), and four further non-modifiable demographic factors were
28
29 354 associated with a decreased NFR score. These were consultant grade
30
31 355 seniority, male gender, absence of long-term health condition or disability, and
32
33 356 working in a paediatric only ED.
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38 357

40 358 The NFR score found in this study compares unfavourably with multiple other
41
42 359 occupational groups. Whilst several confounders should be considered, useful
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44 360 context against which to compare our findings does exist, albeit not from UK
45
46 361 settings. Measurement in shift workers (including hospital nurses) showed
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48 362 significantly lower NFR scores, [11,31] as did studies of heavy goods vehicle
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50 363 drivers and merchant seafarers, all with average NFR scores in the range 36-
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52 364 44.[34,35]

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57 365 The three modifiable occupational factors represent areas of autonomy
58
59 366 and control, correlating well with previous work establishing these as core
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2
3 367 drivers to minimise physician workplace stress and ensure well-being. [2,36,37]
4
5 368 Prioritising change in these domains may result in NFR score reduction, and
6
7 369 reduce negative effects on health and well-being including occupational
8
9
10 370 burnout. Whilst out of hours working is inherent and unavoidable in EM, the
11
12 371 linear relationship we observed suggests that any reduction may result in direct
13
14 372 improvements in NFR, and evidence-based strategies such as proportional
15
16 373 control of 'out of hours' working, annualised rota patterns and/or provision of
17
18 374 rest facilities should therefore be considered urgently.[38–40]
19
20

21 375 As NFR does not change with seniority prior to consultant level it is
22
23 376 possible that the reduction in NFR seen in this cohort supports the hypothesis
24
25 377 that broader perceptions of job autonomy and control, likely gained at this level,
26
27 378 may be explicitly linked to well-being in healthcare.[2,37] Further areas merit
28
29 379 exploration including the link to out of hours working and possible qualitative
30
31 380 enquiry of personal experience and clinical performance.
32
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35 381
36
37 382 The relationship observed between gender and NFR is likely to be overly
38
39 383 simplistic requiring further evaluation. Presumed confounding variables
40
41 384 affecting this issue (such as a primary carer role and domestic responsibilities)
42
43 385 have been previously reported to be unrelated or protective against
44
45 386 maladaptive fatigue and are supported with findings from this study. [41]
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49 387 Awareness of the four demographic factors identified could be important at a
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51 388 departmental planning level and increase advocacy for colleagues at greatest
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53 389 risk of impaired well-being.
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3 391 The main strength of our study is inclusion of responses from over half
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5 392 of all UK EDs, enhancing generalisability of our findings.[42] The high volume
6
7 393 of responses indicate the NFR scale is an acceptable measure for physicians,
8
9 394 with over half of sites exceeding 70% response rates. A key weakness is the
10
11 395 single-point-of-time measurement, as seasonal bias may have affected NFR
12
13 396 scores. Furthermore, we acknowledge the disadvantages of self-administered
14
15 397 dichotomous questionnaires which may limit the richness of insights.[43,44]
16
17 398 Open-ended questions may be desirable in future survey iterations.
18
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21 399 The median NFR observed in our study reflects current challenges
22
23 400 facing EM, and may represent a precursor to sustained burnout in a high
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25 401 proportion of the current workforce. Conversely we have identified simple
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27 402 interventions that may reduce these high levels, and improve well-being.
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29 403 Iterative delivery of the NFR scale following interventions will confirm or refute
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31 404 the impact of such changes, and may identify further areas which will result in
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33 405 continual improvement. Such work should also include other ED staff groups to
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35 406 gain a broader picture across the multiprofessional ED team.
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42 408 In conclusion, this study provides a robust estimate of the NFR for
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44 409 Emergency Physicians in the UK and Ireland, which is higher than any
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46 410 occupation reported to date. Several potentially modifiable occupational
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48 411 characteristics were associated with higher NFR, and future work to assess the
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50 412 impact of modifying these factors will inform strategies to reduce NFR. In time
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52 413 this may lead to improved long-term physician well-being and enhanced staff
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54 414 retention.
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13 420 results.
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19 422 **Competing interests:**
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21 423 All authors have completed the ICMJE uniform disclosure form and declare: no
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32
33 429 have influenced the submitted work.
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39 431 **Patient and Public Involvement statement:**
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41 432 The concept of the research was presented to over 100 members of the
42
43 433 public at a Research & Development PPI Conference on 20th September
44
45 434 2018. Participants were supportive of the concept of the study, and no
46
47 435 concerns were raised. Further public and stakeholder engagement took place
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49 436 through a workshop held at the UK Emergency Medicine Trainees Association
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51 437 Annual Conference in December 2018, this influenced the outcome measures
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53 438 and survey design including the removal of a formal burnout inventory due to
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3 439 perceptions and experience of respondent fatigue in the target participant
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5 440 group.
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10 442 **Ethics Approval:**

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12 443 This study protocol was submitted through the Integrated Research Application
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14 444 System (IRAS), IRAS number 262048 and received proportionate ethical
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17 445 approval by the Health Research Authority and Health and Care Research
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21 447 approvals in Scotland, Northern Ireland and Ireland. All participants provided
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24 448 informed consent prior to beginning the survey
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28 450 **Data sharing:**

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30 451 De-identified participant level data by site will be made available on
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32 452 reasonable request through the study team (tern@rcem.ac.uk). Data will be
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34 453 available for researchers whose proposed use of the data has been approved
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37 454 by the study team.
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42 456 **Transparency statement:**

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44 457 The lead author, Dr Laura Cottey, and the co-authors affirm that this manuscript
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46 458 is an honest, accurate, and transparent account of the study being reported;
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48 459 that no important aspects of the study have been omitted; and that any
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50 460 discrepancies from the study as planned have been explained.
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3 463 **Dissemination to participants and related patient and public**

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5 464 **communities:**

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7 465 The authors are unable to disseminate the result of the research to study
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9 466 participants directly, but the results will be made publicly available through
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13 468 investigators and social media.
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56 487 manuscript; KS and DE provided the statistical analysis plan and contributed to
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16 595 REFERENCES

- 17 596
18
19
20 597 1 The King's Fund. The health care workforce in England: Make or
21 598 Break? 2018. [https://www.kingsfund.org.uk/publications/health-care-](https://www.kingsfund.org.uk/publications/health-care-workforce-england)
22 599 [workforce-england](https://www.kingsfund.org.uk/publications/health-care-workforce-england) (accessed 27 May 2020).
23
24
25 600 2 UK-wide review of doctors and medical students wellbeing - GMC.
26 601 2019. [https://www.gmc-uk.org/about/how-we-work/corporate-strategy-](https://www.gmc-uk.org/about/how-we-work/corporate-strategy-plans-and-impact/supporting-a-profession-under-pressure/uk-wide-review-of-doctors-and-medical-students-wellbeing)
27 602 [plans-and-impact/supporting-a-profession-under-pressure/uk-wide-](https://www.gmc-uk.org/about/how-we-work/corporate-strategy-plans-and-impact/supporting-a-profession-under-pressure/uk-wide-review-of-doctors-and-medical-students-wellbeing)
28 603 [review-of-doctors-and-medical-students-wellbeing](https://www.gmc-uk.org/about/how-we-work/corporate-strategy-plans-and-impact/supporting-a-profession-under-pressure/uk-wide-review-of-doctors-and-medical-students-wellbeing) (accessed 27 May
29 604 2020).
30
31
32
33 605 3 Ramirez AJ, Graham J, Richards MA, *et al.* Mental health of hospital
34 606 consultants: The effects of stress and satisfaction at work. *Lancet*
35 607 1996;347:724–8. doi:10.1016/S0140-6736(96)90077-X
36
37
38 608 4 Salen P, Norman K. The Impact of Fatigue on Medical Error and
39 609 Clinician Wellness: A Vignette-Based Discussion. In: *Vignettes in*
40 610 *Patient Safety - Volume 2*. 2018. doi:10.5772/intechopen.70712
41
42
43
44 611 5 Arora M, Asha S, Chinnappa J, *et al.* Review article: Burnout in
45 612 emergency medicine physicians. *Emerg Med Australas* 2013;25:491–5.
46 613 doi:10.1111/1742-6723.12135
47
48
49 614 6 Han S, Shanafelt TD, Sinsky CA, *et al.* Estimating the attributable cost
50 615 of physician burnout in the United States. *Ann Intern Med* Published
51 616 Online First: 2019. doi:10.7326/M18-1422
52
53
54 617 7 Rotenstein LS, Torre M, Ramos MA, *et al.* Prevalence of burnout
55 618 among physicians a systematic review. *JAMA* 2018;320:1131–50.
56 619 doi:10.1001/jama.2018.12777
57
58
59 620 8 Shanafelt TD, Hasan O, Dyrbye LN, *et al.* Changes in Burnout and
60

- 1
2
3 621 Satisfaction with Work-Life Balance in Physicians and the General US
4
5 622 Working Population between 2011 and 2014. *Mayo Clin Proc*
6
7 623 2015;**90**:1600–13. doi:10.1016/j.mayocp.2015.08.023
8
9 624 9 The Lancet T. Physician burnout: a global crisis. *Lancet* 2019;394:93.
10 625 doi:10.1016/S0140-6736(19)31573-9
11
12 626 10 West CP, Dyrbye LN, Erwin PJ, *et al*. Interventions to prevent and
13
14 627 reduce physician burnout: a systematic review and meta-analysis.
15 628 *Lancet* 2016;388:2272–81. doi:10.1016/S0140-6736(16)31279-X
16
17 629 11 Sluiter JK, De Croon EM, Meijman TF, *et al*. Need for recovery from
18
19 630 work related fatigue and its role in the development and prediction of
20
21 631 subjective health complaints. *Occup Environ Med* Published Online
22
23 632 First: 2003. doi:10.1136/oem.60.suppl_1.i62
24
25 633 12 Sluiter JK, Frings-Dresen MH, van der Beek AJ, *et al*. The relation
26
27 634 between work-induced neuroendocrine reactivity and recovery,
28
29 635 subjective need for recovery, and health status. *J Psychosom Res*
30
31 636 2001;**50**:29–37. doi:10.1016/s0022-3999(00)00213-0
32
33 637 13 GMC. General Medical Council. National training surveys 2019: Initial
34
35 638 findings report. 2019. [https://www.gmc-uk.org/-/media/gmc-site-](https://www.gmc-uk.org/-/media/gmc-site-images/about/national-training-surveys-initial-findings-report-20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5D0B391744B0)
36
37 639 [images/about/national-training-surveys-initial-findings-report-](https://www.gmc-uk.org/-/media/gmc-site-images/about/national-training-surveys-initial-findings-report-20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5D0B391744B0)
38
39 640 [20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5](https://www.gmc-uk.org/-/media/gmc-site-images/about/national-training-surveys-initial-findings-report-20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5D0B391744B0)
40
41 641 [D0B391744B0](https://www.gmc-uk.org/-/media/gmc-site-images/about/national-training-surveys-initial-findings-report-20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5D0B391744B0) (accessed 27 May 2020).
42
43 642 14 Panagioti M, Panagopoulou E, Bower P, *et al*. Controlled interventions
44
45 643 to reduce burnout in physicians a systematic review and meta-analysis.
46
47 644 *JAMA Intern Med* 2017;177:195–205.
48
49 645 doi:10.1001/jamainternmed.2016.7674
50
51 646 15 Dewa CS, Jacobs P, Thanh NX, *et al*. An estimate of the cost of burnout
52
53 647 on early retirement and reduction in clinical hours of practicing
54
55 648 physicians in Canada. *BMC Health Serv Res* 2014;14.
56
57 649 doi:10.1186/1472-6963-14-254
58
59 650 16 National Academies of Sciences E and M. *Taking Action Against*
60
651 *Clinician Burnout*. Washington, D.C. National Academies Press 2019.
652
653 652 doi:10.17226/25521
654
655 653 17 Sluiter JK, Van Der Beek AJ, Frings-Dresen MHW. The influence of
656
657 654 work characteristics on the need for recovery and experienced health: A

- 1
2
3 655 study on coach drivers. *Ergonomics* 1999;42:573–83.
4
5 656 doi:10.1080/001401399185487
6
7 657 18 Jansen NWH, Kant I, Van Amelsvoort LGPM, *et al.* Need for recovery
8
9 658 from work: Evaluating short-term effects of working hours, patterns and
10
11 659 schedules. *Ergonomics* Published Online First: 2003.
12
13 660 doi:10.1080/0014013031000085662
14
15 661 19 Smith J, Keating L, Flowerdew L, *et al.* An Emergency Medicine
16
17 662 Research Priority Setting Partnership to establish the top 10 research
18
19 663 priorities in emergency medicine. *Emerg Med J* Published Online First:
20
21 664 2017. doi:10.1136/emered-2017-206702
22
23 665 20 Eysenbach G. Improving the Quality of Web Surveys: The Checklist for
24
25 666 Reporting Results of Internet E-Surveys (CHERRIES). *J Med Internet*
26
27 667 *Res* 2004;6:e34. doi:10.2196/jmir.6.3.e34
28
29 668 21 Medicine RC of E. Essential Facts Regarding A&E Services.
30
31 669 2018. [https://www.rcem.ac.uk/docs/Policy/England Factsheet 2018.pdf](https://www.rcem.ac.uk/docs/Policy/England_Factsheet_2018.pdf)
32
33 670 (accessed 27 May 2020).
34
35 671 22 Cottey L, Vassallo J, Roberts T, Horner D, Tabner A. About TERN? -
36
37 672 RCEMLearning. <https://www.rcemlearning.co.uk/foamed/about-tern/>
38
39 673 (accessed 27 May 2020)
40
41 674 23 Lyttle MD, O'Sullivan R, Hartshorn S, *et al.* Pediatric Emergency
42
43 675 Research in the UK and Ireland (PERUKI): Developing a collaborative
44
45 676 for multicentre research. *Arch Dis Child* 2014;99:602–3.
46
47 677 doi:10.1136/archdischild-2013-304998
48
49 678 24 Van Veldhoven M, Meijman TF. *Het meten van psychosociale*
50
51 679 *arbeidsbelasting met een vragenlijst: De Vragenlijst Beleving en*
52
53 680 *Beoordeling van de Arbeid (VBBA). [Questionnaire on Perception and*
54
55 681 *Judgement of Work]*. 1994.
56
57 682 25 Van Veldhoven M, Broersen S. Measurement quality and validity of the
58
59 683 “need for recovery scale”. *Occup Environ Med* Published Online First:
60
684 2003. doi:10.1136/oem.60.suppl_1.i3
685 26 Graham B, Cottey L, Smith J, *et al.* Measuring ‘Need for Recovery’ as
686
687 an indicator of staff wellbeing in the Emergency Department—a survey
688 27 Harris PA, Taylor R, Minor BL, *et al.* The REDCap consortium: Building

- 1
2
3 689 an international community of software platform partners. *J Biomed*
4 690 *Inform* 2019;95:103208. doi:10.1016/J.JBI.2019.103208
- 5
6 691 28 Harris PA, Taylor R, Thielke R, *et al.* Research electronic data capture
7 692 (REDCap)—A metadata-driven methodology and workflow process for
8 693 providing translational research informatics support. *J Biomed Inform*
9 694 2009;42:377–81. doi:10.1016/J.JBI.2008.08.010
- 10
11 695 29 StataCorp. Stata Statistical Software: Release 14. College Station, TX:
12 696 StataCorp LP. 2015. 2015. doi:10.2307/2234838
- 13
14 697 30 Van Der Starre RE, Coffeng JK, Hendriksen IJ, *et al.* Associations
15 698 between overweight, obesity, health measures and need for recovery in
16 699 office employees: A cross-sectional analysis. *BMC Public Health*
17 700 Published Online First: 2013. doi:10.1186/1471-2458-13-1207
- 18
19 701 31 Moriguchi CS, Trevizani T, De Fátima Carreira Moreira R, *et al.* Need
20 702 for recovery assessment among nursing professionals and call center
21 703 operators. In: *Work*. 2012. 4838–42. doi:10.3233/WOR-2012-0773-4838
- 22
23 704 32 Nieuwenhuijsen K, Sluiter JK, Dewa CS. Need for recovery as an early
24 705 sign of depression risk in a working population. *J Occup Environ Med*
25 706 Published Online First: 2016. doi:10.1097/JOM.0000000000000866
- 26
27 707 33 Samadi H, Kalantari R, Mostafavi F, *et al.* Using the Need for Recovery
28 708 Scale to Assess Workload in Mine Workers and Its Relationship With
29 709 Demographics. *J Ergon* 2017;4:1–7. doi:10.21859/joe-04041
- 30
31 710 34 Bridger RS, Brasher K, Dew A. Work demands and need for recovery
32 711 from work in ageing seafarers. *Ergonomics* 2010;53:1006–15.
33 712 doi:10.1080/00140139.2010.493958
- 34
35 713 35 De Croon EM, Sluiter JK, Frings-Dresen MHW. Need for recovery after
36 714 work predicts sickness absence: A 2-year prospective cohort study in
37 715 truck drivers. *J Psychosom Res* 2003;55:331–9. doi:10.1016/S0022-
38 716 3999(02)00630-X
- 39
40 717 36 Hall LH, Johnson J, Heyhoe J, *et al.* Strategies to improve general
41 718 practitioner well-being: Findings from a focus group study. *Fam Pract*
42 719 Published Online First: 2018. doi:10.1093/fampra/cmz130
- 43
44 720 37 Galletta M, Portoghese I, Fabbri D, *et al.* Empowering workplace and
45 721 wellbeing among healthcare professionals: The buffering role of job
46 722 control. *Acta Biomed* 2016;87:61–9.

- 1
2
3 723 38 NHS Improvement. Annualised hours rotas for emergency department
4 724 doctors. 2019.
5
6 725 [https://improvement.nhs.uk/documents/5919/Brighton__Sussex_-](https://improvement.nhs.uk/documents/5919/Brighton__Sussex_-_annualised_hours_rotas.pdf)
7
8 726 [_annualised_hours_rotas.pdf](https://improvement.nhs.uk/documents/5919/Brighton__Sussex_-_annualised_hours_rotas.pdf) (accessed 27 May 2020).
9
10 727 39 Rimmer A. Government commits £10m to doctors' rest facilities. *BMJ*
11 728 2233 doi: <http://doi.org/10.1136/bmj.l2233>
12
13 729 40 Smith E, Dasan S. A system under pressure. *Br J Hosp Med*
14 730 2018;79:495–9. doi:10.12968/hmed.2018.79.9.495
15
16
17 731 41 Winwood PC, Winefield AH, Lushington K. Work-related fatigue and
18 732 recovery: The contribution of age, domestic responsibilities and
19 733 shiftwork. *J Adv Nurs* 2006;56:438–49. doi:10.1111/j.1365-
20 734 2648.2006.04011.x
21
22
23 735 42 Hassan T, Walker B, Harrison M, *et al*.
24 736 [www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-](http://www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-October_2013.pdf)
25 737 [October_2013.pdf](http://www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-October_2013.pdf). 2013.[www.rcem.ac.uk/docs/Policy/CEM7461-](http://www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-October_2013.pdf)
26 738 [Stretched-to-the-limit-October_2013.pdf](http://www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-October_2013.pdf) (accessed 27 Ma7 2020).
27
28
29 739 43 Dykema J, Jones NR, Piché T, *et al*. Surveying Clinicians by Web:
30 740 Current Issues in Design and Administration. *Eval Heal Prof* Published
31 741 Online First: 2013;36:352-81. doi:10.1177/0163278713496630
32
33
34 742 44 Klabunde CN, Willis GB, McLeod CC, *et al*. Improving the Quality of
35 743 Surveys of Physicians and Medical Groups: A Research Agenda. *Eval*
36 744 *Heal Prof* 2012;35:477-506 doi:10.1177/0163278712458283
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758 Research Checklist: The Checklist for Reporting Results of Internet E-Surveys
759 (CHERRIES)

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CHERRIES CHECKLIST ADAPTED FROM:			
Eysenbach, Gunther. "Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES)." <i>Journal of medical Internet research</i> vol. 6,3 e34. 29 Sep. 2004, doi:10.2196/jmir.6.3.e34			
Item Category	Checklist Item	Explanation	Checklist Response
Design	Describe survey design	Describe target population, sample frame. Is the sample a convenience sample? (In "open" surveys this is most likely.)	Outlined in 'Methods'
IRB (Institutional Review Board) approval and informed consent process	IRB approval	Mention whether the study has been approved by an IRB.	Outlined in 'Ethics Approval'
	Informed consent	Describe the informed consent process. Where were the participants told the length of time of the survey, which data were stored and where and for how long, who the investigator was, and the purpose of the study?	Outlined in Survey Distribution, monitoring and recruitment
	Data protection	If any personal information was collected or stored, describe what mechanisms were used to protect unauthorized access.	Outlined in Survey Distribution, monitoring and recruitment
Development and pre-testing	Development and testing	State how the survey was developed, including whether the usability and technical functionality of the electronic questionnaire had been tested before fielding the questionnaire.	Outlined in 'Survey Development'
Recruitment process and description of the sample having access to the questionnaire	Open survey versus closed survey	An "open survey" is a survey open for each visitor of a site, while a closed survey is only open to a sample which the investigator knows (password-protected survey).	Outlined in Survey Distribution, monitoring and recruitment
	Contact mode	Indicate whether or not the initial contact with the potential participants was made on the Internet. (Investigators may also send out questionnaires by mail and allow for Web-based data entry.)	Outlined in 'Survey Distribution, monitoring and recruitment'
	Advertising the survey	How/where was the survey announced or advertised? Some examples are offline media (newspapers), or online (mailing lists – If yes, which ones?) or banner ads (Where were these banner ads posted and what did they look like?). It is important to know the wording of the announcement as it will	Outlined in 'Survey Distribution, monitoring and recruitment'

		heavily influence who chooses to participate. Ideally the survey announcement should be published as an appendix.	
Survey administration	Web/E-mail	State the type of e-survey (eg, one posted on a Web site, or one sent out through e-mail). If it is an e-mail survey, were the responses entered manually into a database, or was there an automatic method for capturing responses?	<i>Outlined in 'Survey Distribution, monitoring and recruitment'</i>
	Context	Describe the Web site (for mailing list/newsgroup) in which the survey was posted. What is the Web site about, who is visiting it, what are visitors normally looking for? Discuss to what degree the content of the Web site could pre-select the sample or influence the results. For example, a survey about vaccination on a anti-immunization Web site will have different results from a Web survey conducted on a government Web site	<i>Outlined in 'Design'</i>
	Mandatory/voluntary	Was it a mandatory survey to be filled in by every visitor who wanted to enter the Web site, or was it a voluntary survey?	<i>Outlined in 'Survey Distribution, monitoring and recruitment'</i>
	Incentives	Were any incentives offered (eg, monetary, prizes, or non-monetary incentives such as an offer to provide the survey results)?	No
	Time/Date	In what timeframe were the data collected?	<i>Outlined in 'Sites and settings'</i>
	Randomization of items or questionnaires	To prevent biases items can be randomized or alternated.	<i>Not done</i>
	Adaptive questioning	Use adaptive questioning (certain items, or only conditionally displayed based on responses to other items) to reduce number and complexity of the questions	<i>Outlined in Survey Distribution, monitoring and recruitment</i>
	Number of Items	What was the number of questionnaire items per page? The number of items is an important factor for the completion rate.	<i>Outlined in 'Design'</i>
	Number of screens (pages)	Over how many pages was the questionnaire distributed? The number of items is an important factor for the completion rate.	<i>Outlined in 'Design'</i>
	Completeness check	It is technically possible to do consistency or completeness checks before the questionnaire is submitted. Was this done, and if "yes", how (usually JavaScript)? An alternative is to check for completeness after the questionnaire has been submitted (and	<i>Not done</i>

		highlight mandatory items). If this has been done, it should be reported. All items should provide a non-response option such as “not applicable” or “rather not say”, and selection of one response option should be enforced.	
	Review step	State whether respondents were able to review and change their answers (eg, through a Back button or a Review step which displays a summary of the responses and asks the respondents if they are correct).	Outlined in Survey Distribution, monitoring and recruitment
Response rates			
	Unique site visitor	If you provide view rates or participation rates, you need to define how you determined a unique visitor. There are different techniques available, based on IP addresses or cookies or both.	Outlined in ‘Results’
	View rate (Ratio of unique survey visitors/unique site visitors)	Requires counting unique visitors to the first page of the survey, divided by the number of unique site visitors (not page views!). It is not unusual to have view rates of less than 0.1 % if the survey is voluntary	Survey site contains first page of survey therefore N/A
	Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)	Count the unique number of people who filled in the first survey page (or agreed to participate, for example by checking a checkbox), divided by visitors who visit the first page of the survey (or the informed consents page, if present). This can also be called “recruitment” rate.	Outlined in ‘Results’
	Completion rate (Ratio of users who finished the survey/users who agreed to participate)	The number of people submitting the last questionnaire page, divided by the number of people who agreed to participate (or submitted the first survey page). This is only relevant if there is a separate “informed consent” page or if the survey goes over several pages. This is a measure for attrition. Note that “completion” can involve leaving questionnaire items blank. This is not a measure for how completely questionnaires were filled in. (If you need a measure for this, use the word “completeness rate”.)	Outlined in ‘Results’
Preventing multiple entries from the same individual	Cookies used	Indicate whether cookies were used to assign a unique user identifier to each client computer. If so, mention the page on which the cookie was set and read, and how long the cookie was valid. Were duplicate entries avoided by preventing users access to the survey twice; or were duplicate database entries having the same user ID eliminated before analysis? In the latter case, which entries were kept for analysis (eg, the first entry or the most recent)?	Not used

	IP check	Indicate whether the IP address of the client computer was used to identify potential duplicate entries from the same user. If so, mention the period of time for which no two entries from the same IP address were allowed (eg, 24 hours). Were duplicate entries avoided by preventing users with the same IP address access to the survey twice; or were duplicate database entries having the same IP address within a given period of time eliminated before analysis? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	Not used due to survey being completed on multi-user/single log-in computers
	Log file analysis	Indicate whether other techniques to analyze the log file for identification of multiple entries were used. If so, please describe.	Not done
	Registration	In “closed” (non-open) surveys, users need to login first and it is easier to prevent duplicate entries from the same user. Describe how this was done. For example, was the survey never displayed a second time once the user had filled it in, or was the username stored together with the survey results and later eliminated? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	N/A
Analysis	Handling of incomplete questionnaires	Were only completed questionnaires analyzed? Were questionnaires which terminated early (where, for example, users did not go through all questionnaire pages) also analyzed?	Outlined in ‘Data Analysis’
	Questionnaires submitted with an atypical timestamp	Some investigators may measure the time people needed to fill in a questionnaire and exclude questionnaires that were submitted too soon. Specify the timeframe that was used as a cut-off point, and describe how this point was determined	N/A
	Statistical correction	Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for the non-representative sample; if so, please describe the methods.	Outlined in ‘Data Analysis’

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5 770 **Figure Legend**

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8 772 **Figure 1**

9 773 Box plots of Need for Recovery (NFR) score by participant demographic
10 774 characteristics, excluding any participants who does not respond to the
11 775 question (i.e. missing).

12
13
14 776 Plot a) age group in years; b) gender; c) clinical grade; d) any long-term
15 777 health condition or disability.

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20 779 ST1-ST2=Specialist Training year 1-2 (this included physicians training in
21 780 Anaesthetics, Emergency Medicine, Acute Medicine and General Practice)

22
23 781 SASG=Staff grade, associate specialist and speciality grade

24
25 782 GP=General Practitioner working within the emergency department (ED)

26
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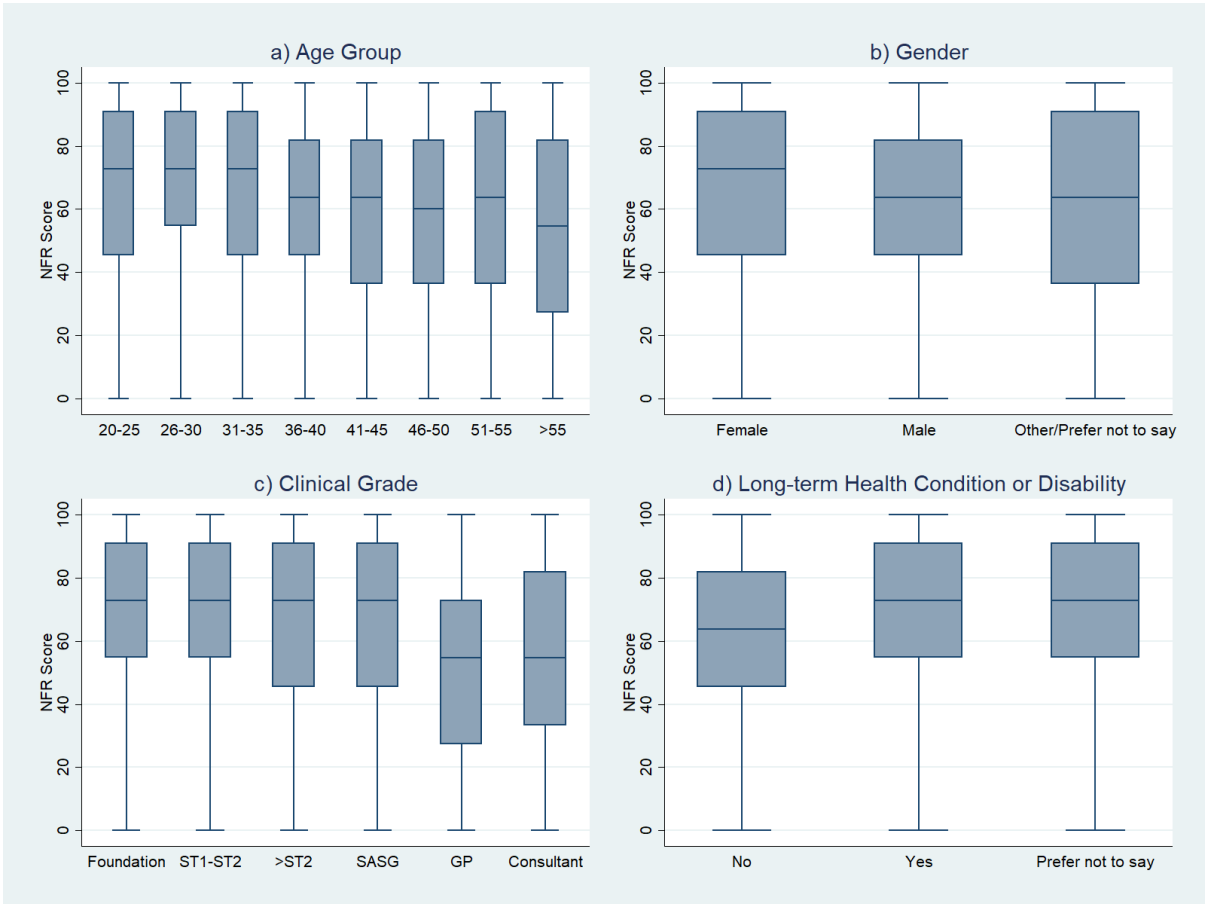
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29 784 **Figure 2**

30 785 Box plot of Need for Recovery (NFR) score by participant's occupational
31 786 characteristics, excluding any participants who does not respond to the
32 787 question (i.e. missing).

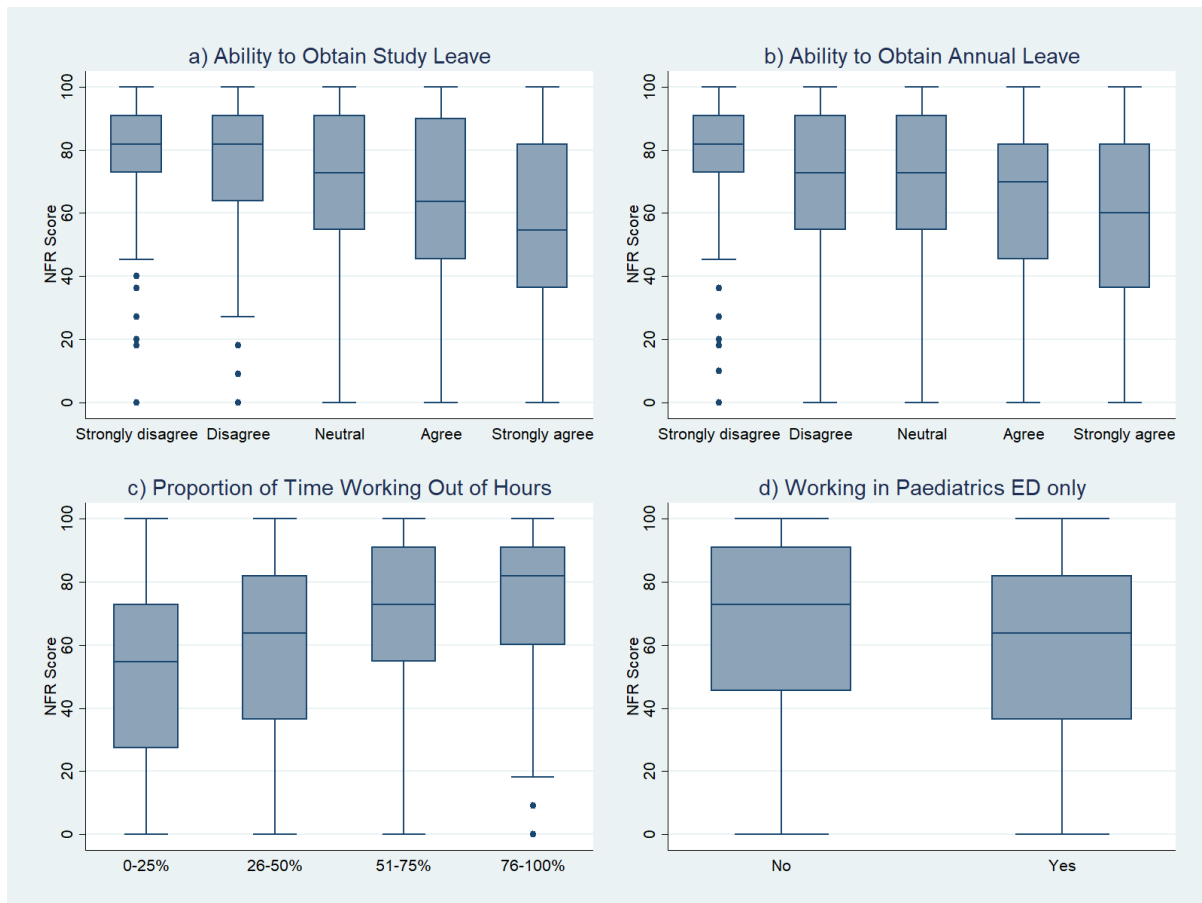
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35 788 Plot a) ability to obtain study leave when requested; b) ability to obtain annual
36 789 leave when requested; c) proportion of time working out of hours; d) working
37 790 in paediatrics emergency departments (ED) only.

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Review only



Review only

Emergency Department Need For Recovery Survey

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Do you want to read the patient participation leaflet, GDPR and consent information now?

- Yes
- No

For peer review only

1 Participant Information Sheet

2
3 Welcome to the 2019 TERN Need for Recovery Survey.

4
5 This is an electronic participant information sheet.
6 Please take a minute or two to read this information
7 before proceeding with the survey.

8
9 What is need for recovery?

10 Need for recovery is the time taken to physically and
11 psychologically recover from work. Increased need
12 for recovery is linked to fatigue and a range of
13 physical and psychological health outcomes including
14 burnout.

15 Why have I been asked to take part?

16 You are either:

- 17 • A doctor working in an emergency department which
18 has been nominated to participate in this survey.

19 What is the purpose of the study?

20 This survey is being conducted as part of a national
21 survey by the Trainee Emergency Research Network
22 (TERN). The project is being led by Dr Laura Cottey
23 (Chief Investigator) and Dr Blair Graham, with
24 oversight from the TERN executive committee. We hope
25 that the results from this survey will provide a
26 baseline assessment of trainee need for recovery,
27 and demonstrate risk factors that may indicate an
28 increased need for recovery. It is hoped that this
29 survey will provide insight into the phenomenon of
30 need for recovery amongst Emergency Department
31 doctors, show where differences exist, and how need
32 for recovery may be reduced in the future.
33 Ultimately it is hoped that this survey may lead to
34 initiatives to improve the working lives of doctors
35 in the emergency department.

36 What will happen if I take part?

37 You will be asked to take part in this electronic
38 questionnaire. You should allocate about 5 minutes
39 to complete the questionnaire, although you can save
40 and return to completing the questionnaire at a
41 later time.

42
43 Do I have to take part?

44 In order that these results can inform future
45 initiatives to improve working lives of emergency
46 doctors, we do require a robust response rate.
47 However, you are under no obligation to take part
48 and may withdraw at any point without the need to
49 give a reason.

50 Should you have uncertainties or queries about this
51 survey, please do not hesitate to contact the study
52 team.

53
54 What will happen to my data if I withdraw my
55 involvement?

56 If you choose to withdraw your involvement in the
57 study, any results that you have submitted will be
58 kept for analysis. However, you will not be required
59 to input further into the study.

60 If you would like to be formally withdrawn from the
study at any point, please contact the study team
(TERN@rcem.ac.uk). You do not have to give a reason.

For peer review only - <http://bmjopen.bmj.com/site/about/guidelines.xhtml>

Are there any potential risks or benefits of taking

This survey will provide valuable insight into the wellbeing of emergency department doctors nationally. We appreciate issues such as wellbeing and burnout are sensitive. We have included some information about sources that you might wish to contact for support both as part of this introduction, and at the end of the survey.

Who is involved in this project?

The project is being led by Dr Laura Cottey (Chief Investigator) and Dr Blair Graham, with oversight from the TERN executive committee which is led by Dr Tom Roberts. The study is indirectly supported by the Royal College of Emergency Medicine, but TERN is independent from the college.

What if something goes wrong?

It is very unlikely that anything will go wrong. If you feel it does, please contact the study team directly.

How will you protect my data and confidentiality?

The University Hospitals Plymouth NHS Trust is the sponsor for this study. The sponsor will be using information in order to undertake the study and will be responsible for looking after your information and using it properly. The data collected will be kept for 10 years after the study has finished.

Your rights to access, change or move your information are limited, as we need to manage your information in specific ways in order for the research to be reliable and accurate. If you withdraw from the study, we will keep the information about you that we have already obtained. To safeguard your rights, we will use the minimum personally identifiable information possible.

This study is also compliant with the General Data Protection Regulations (GDPR). For more information about GDPR click here.

How may I contact the study team in the future?

You can contact the study team by emailing Dr Laura Cottey at laura.cottey@nhs.net

What to do if you need support about wellbeing

The following organisations can help provide advice and support with regards to your wellbeing.

-Your occupational health department (contact details available via your employer)

-Your general practitioner

-BMA Counselling Service (24 Hours). Telephone 0330 123 1245. (Note that you do not have to be a member of the BMA to access this service)

-The Samaritans (24 Hours). Telephone 116 123.

You can also access further information and signposting online via the Doctors Support Network <https://www.dsn.org.uk/>

Feel free to leave any comments.

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Consent Question 1: Yes
I have read and understood the participant No
information

Consent Question 2: Yes
I understand the information about confidentiality No
and GDPR

For peer review only

Demographic Characteristics

What is your current job role?

- ST1
 ST2
 ST3
 ST4
 ST5
 ST6
 ST7
 ST8
 F1
 F2
 Clinical Fellow (F2-ST3 Level)
 Clinical Fellow (>=ST4 Level)
 Consultant
 Associate Specialist
 Staff Grade
 CESR Doctor
 GP Trainee
 GP
 Other (please specify)

What is your job role?

Which country do you work in?

- Scotland
 Northern Ireland
 Wales
 England
 Republic of Ireland

Which hospital do you currently work in?

- Aberdeen
 Victoria Hospital, Kirkcaldy
 Forth Valley Royal Hospital
 Monklands Hospital
 Royal Hospital for Children, Glasgow
 Royal Infirmary of Edinburgh
 St John's, Livingston
 NHS Greater Glasgow and Clyde - Queen Elizabeth
 NHS Greater Glasgow and Clyde - Glasgow Royal Infirmary
 Crosshouse, Ayrshire
 Royal Alexandria, Paisley
 Ayr
 Royal Hospital for Sick Children, Edinburgh
 Other

Which hospital do you currently work in?

- Craigavon Area Hospital, Northern Ireland
 Royal Victoria Hospital, Belfast
 Ulster Hospital, Belfast
 Other

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Which hospital do you currently work in?

- Cardiff, University Hospital of Wales
- Ysbyty Gwynedd, Bangor
- Morriston Hospital, Swansea
- Wrexham, North Wales
- Other

For peer review only

1 Which hospital do you currently work in (the list is mostly alphabetically but if you cannot find your hospital please
2 check the bottom)?
3

- 4 Addenbrooke's Hospital
5 Aintree
6 Airedale General Hospital
7 Basingstoke Emergency Department
8 Bedford hospital emergency department
9 Birmingham
10 Bolton
11 Bradford Royal Infirmary
12 Brighton (Royal Sussex County Hospital)
13 Bristol Childrens Hospital
14 Bristol Royal Infirmary (Adults)
15 Cambridge University Hospitals
16 Chelsea & Westminster Hospital
17 Croydon University Hospital
18 Doncaster Royal Infirmary
19 William Harvey ED
20 East Surrey Hospital ED
21 Epsom and St Helier NHS Trust
22 Gloucestershire Hospitals NHS Foundation Trust
23 Great Western Hospital Swindon
24 Hampshire Hospitals NHS Trust (Basingstoke and Winchester)
25 Harrogate Emergency Department
26 Homerton Emergency Department
27 Ipswich Hospital
28 James Cook University Hospital Middlesbrough
29 James Paget University Hospital
30 Leeds teaching hospitals
31 Leicester Royal Infirmary
32 Leighton (Crewe)
33 Lewisham university hospital
34 Lister Hospital
35 QEH, London
36 Manchester Royal Infirmary
37 Milton Keynes University
38 Musgrove Park Hospital, Taunton
39 Northern general hospital
40 Northumbria Specialist Emergency Care Hospital
41 Northwick Park Hospital
42 Oxford University Hospital NHS Foundation Trust/
43 Portsmouth - Queen Alexandra Hospital,
44 Plymouth- Derriford
45 Reading
46 Royal Berkshire Hospital
47 Royal Blackburn Hospital
48 Royal Cornwall Hospital, Truro
49 Royal Devon & Exeter Hospital
50 Royal Liverpool University Hospital
51 The Royal London Hospital (Paeds)
52 The Royal London Hospital (Adults)
53 Royal Manchester Children's Hospital
54 Royal Oldham Hospital
55 Royal Preston hospital
56 Royal Shrewsbury Hospital
57 Royal Stoke
58 Royal Surrey County Hospital
59 Royal United Hospital Bath
60 Royal Victoria, Newcastle
 Salford Royal Hospital, Manchester
 Sheffield Childrens Hospital ED
 Medway Foundation NHS Trust
 Mid Cheshire Hospitals NHS Foundation Trust
 University Hospital Southampton
 St Helens and Knowsley
 Southmead Hospital
 Surrey and Sussex Healthcare NHS Trust
 St George's Hospital Tooting

For peer review only

- 1 St Marys Hospital, London
2 St Richards hospital
3 St Thomas' Hospital
4 Torbay
5 Tunbridge Wells Hospital
6 Southport District General Hospital
7 University College Hospital, London
8 University Hospital Coventry and Warwickshire
9 Warrington
10 University Hospitals of Derby and Burton NHS Foundation Trust
11 Watford General hospital
12 West Middlesex University Hospital
13 West Suffolk Hospital
14 Frimley Park Hospital
15 Wexham Park Hospital, Frimley Health NHS
16 Whiston Hospital
17 Wythenshawe Hospital
18 Yeovil District Hospital
19 York District hospital
20 York Hospital Emergency Departments
21 Whiston Hospital
22 William Harvey Hospital
23 Worthing Hospital
24 University hospital of Hull
25 North Middlesex
26 Sandwell and West Birmingham
27 Stoke Mandeville
28 Colchester
29 Alder Hey Children's Hospital
30 Queen's Hospital, Romford
31 Birmingham Children's Hospital
32 Sunderland Royal Hospital
33 Countess of Chester NHS foundation trust
34 University hospital of North Durham
35 Evelina Children's Hospital
36 King's College, London
37 Barnstaple
38 Nottingham University Hospital
39 Royal Alexandra Children's Hospital
40 Royal Wolverhampton
41 Salisbury NHS Trust
42 Western Sussex NHS Trust
43 Other
44 Alder Hey Childrens Hospital
45 Birmingham Women's and Childrens Hospital
46 Countess of Chester
47 Evelina, Guys and St Thomas's
48 Kings College Hospital
49 Royal Alexandra Children's Hospital, Brighton and Sussex
50 New Cross Hospital
51 Salisbury
52 Barking, Havering & Redbridge - Queen's
53 Barking, Havering & Redbridge - King George
54 South Tyneside and Sunderland NHS Trust
55 County Durham and Darlington
56 North Manchester General Hospital

1 Which hospital do you currently work in?
2

- 3 University Hospital Galway
- 4 Mater Misericordiae University Hospital, Dublin,
- 5 Sligo University Hospital
- 6 Limerick regional Hospital
- 7 Other
- 8 Children's Health Ireland at Crumlin
- 9 Children's Health Ireland at Temple Street
- 10 Children's Health Ireland at Tallaght
- 11 Bon Secours Hospital
- 12 Cork University Hospital

13
14 Please state the name of your hospital.
15
16
17 _____
18 _____

19 What type of patients do you see in your Emergency Department?
20

- 21 Adults only
- 22 Paediatrics only
- 23 Mixture of Adults and Paediatrics

24
25 How old are you?
26

- 27 20-25
- 28 26-30
- 29 31-35
- 30 36-40
- 31 41-45
- 32 46-50
- 33 51-55
- 34 56-60
- 35 61- 65
- 36 66-70
- 37 >70

38
39 What is your gender?
40

- 41 Female
- 42 Male
- 43 Other
- 44 Prefer not to say

Please fill out the following "Need for Recovery Score". Please base this on the LAST MONTH of work (excluding leave).

	yes	no
I find it difficult to relax at the end of the working day?	<input type="radio"/>	<input type="radio"/>
By the end of the working day I feel really worn-out	<input type="radio"/>	<input type="radio"/>
Because of my job, at the end of the working day I feel rather exhausted	<input type="radio"/>	<input type="radio"/>
After my breaks, I feel fresh to continue my work	<input type="radio"/>	<input type="radio"/>
Generally speaking, I only start to feel relaxed on my second non-working day off	<input type="radio"/>	<input type="radio"/>
I find it difficult to concentrate in my free time after work	<input type="radio"/>	<input type="radio"/>
I find it hard to show interest in other people when I have just come home from work	<input type="radio"/>	<input type="radio"/>
In general, it takes me over an hour to feel fully recuperated after work	<input type="radio"/>	<input type="radio"/>
When I get home, I need to be left in peace for a while	<input type="radio"/>	<input type="radio"/>
Often, after a day's work I feel so tired that I cannot get involved in other activities	<input type="radio"/>	<input type="radio"/>
A feeling of tiredness prevents me from doing my work as well as I normally would during the last part of the working day	<input type="radio"/>	<input type="radio"/>

How long have you worked in your current Emergency Department?

- 1 month or less
- 1-2 months
- 2-3 months
- 3-4 months
- 4-5 months
- 5-6 months
- 6 months - 1 year
- 1-2 years
- 2-3 years
- 3-5 years
- 5 -10 years
- 10 -15 years
- 15-20 years
- > 20 years

1 How long have you worked in Emergency Medicine in total in your career?
2

- 3 1 year or less
4 1 year or more
5

6 How many months have you worked in Emergency Medicine in total?
7

8 _____
9
10

11 How many years have you worked in Emergency Medicine in total?
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13 _____
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16 What is your most frequent method of transport for your commute to work?
17

- 18 Car
19 Motorbike
20 Bus
21 Train
22 Underground
23 Walk
24 Run
25 Cycle
26 I live on-site
27 Other
28

29 You have selected other, how do you commute?
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How long does your commute take in minutes (one way)?

	1-10 mins	11-20 mins	21-30 mins	31-40 mins	41-50 mins	51-60 mins	61-70 mins	71-80 mins	81-90 mins	>90 mins
On an average day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On a good day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On a bad day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What type of contract do you work?

- Full time
 90%, less than full time
 80%, less than full time
 70%, less than full time
 60%, less than full time
 50%, less than full time
 less than 50%, less than full time

Do you have dedicated contracted time away from Adult Emergency Medicine (e.g. subspecialty or GP) or work in Paediatric Emergency Medicine?

- Yes
 No

Please select all that are applicable to your current contracted time.

- ICM
 PEM
 PHEM
 Academic
 Teaching
 Leadership/Management
 Paediatrics
 GP
 Other

What is your "other" contracted time?

What percentage of your contract is spent in ICM rather than EM?

- 10%
 20%
 25%
 30%
 40%
 50%
 60%
 70%
 75%
 80%
 90%
 100%

1 What percentage of your contract is spent in PEM rather than Adult EM?
2

- 3 10%
- 4 20%
- 5 25%
- 6 30%
- 7 40%
- 8 50%
- 9 60%
- 10 70%
- 11 75%
- 12 80%
- 13 90%
- 14 100%

16 What percentage of your contract is spent in PHEM rather than Adult EM?
17

- 18 10%
- 19 20%
- 20 25%
- 21 30%
- 22 40%
- 23 50%
- 24 60%
- 25 70%
- 26 75%
- 27 80%
- 28 90%
- 29 100%

31 What percentage of your contract is spent Academic rather than Adult EM?
32

- 33 10%
- 34 20%
- 35 25%
- 36 30%
- 37 40%
- 38 50%
- 39 60%
- 40 70%
- 41 75%
- 42 80%
- 43 90%
- 44 100%

45 What percentage of your contract is spent Teaching rather than Adult EM?
46

- 47 10%
- 48 20%
- 49 25%
- 50 30%
- 51 40%
- 52 50%
- 53 60%
- 54 70%
- 55 75%
- 56 80%
- 57 90%
- 58 100%
- 59
- 60

1 What percentage of your contract is spent management/leadership rather than Adult EM?
2

- 3 10%
4 20%
5 25%
6 30%
7 40%
8 50%
9 60%
10 70%
11 75%
12 80%
13 90%
14 100%

16 What percentage of your contract is spent doing paediatrics rather than EM?
17

- 18 10%
19 20%
20 25%
21 30%
22 40%
23 50%
24 60%
25 70%
26 75%
27 80%
28 90%
29 100%

31 What percentage of your contract is spent doing GP rather than Adult EM?
32

- 33 10%
34 20%
35 25%
36 30%
37 40%
38 50%
39 60%
40 70%
41 75%
42 80%
43 90%
44 100%

45 What percentage of your contract is spent doing "other" activities rather than Adult EM?
46

- 47 10%
48 20%
49 25%
50 30%
51 40%
52 50%
53 60%
54 70%
55 75%
56 80%
57 90%
58 100%
59
60

1 What is the maximum number of TOTAL clinical shifts you work in a week?
2

- 3 1 shift
- 4 2 shifts
- 5 3 shifts
- 6 4 shifts
- 7 5 shifts
- 8 6 shifts
- 9 7 shifts

11 What is the maximum number of CONSECUTIVE clinical shifts you would be scheduled to work?
12

- 13 1 shift
- 14 2 shifts
- 15 3 shifts
- 16 4 shifts
- 17 5 shifts
- 18 6 shifts
- 19 7 shifts
- 20 > 7 shifts

22 What is the maximum number of consecutive NIGHT shifts you would be scheduled to work in a row?
23

- 24 0 shifts
- 25 1 shift
- 26 2 shifts
- 27 3 shifts
- 28 4 shifts
- 29 5 shifts
- 30 6 shifts
- 31 7 shifts

33 What is the maximum number of consecutive DAY shifts you would be scheduled to work in a row?
34

- 35 0 shifts
- 36 1 shift
- 37 2 shifts
- 38 3 shifts
- 39 4 shifts
- 40 5 shifts
- 41 6 shifts
- 42 7 shifts

44 What is the maximum number of consecutive TWILIGHT shifts you would be scheduled to work in a row?
45

- 46 0 shifts
- 47 1 shift
- 48 2 shifts
- 49 3 shifts
- 50 4 shifts
- 51 5 shifts
- 52 6 shifts
- 53 7 shifts

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1 What is your scheduled weekend work frequency?
2

- 3 1 in 2
4 1 in 3
5 1 in 4
6 1 in 5
7 1 in 6
8 Less frequent than 1 in 6
9 I don't work weekends

10
11 Over the past month how many contracted non-clinical shifts have you had? E.g. SPA, teaching, clinical governance.
12

- 13 0 shifts
14 Between 0-1 shifts
15 1 shift
16 2 shifts
17 3 shifts
18 4 shifts
19 5 shifts
20 6 shifts
21 7 shifts
22 8 shifts
23 9 shifts
24 10 shifts
25 11-15 shifts
26 >15 shifts

27
28 In the past month how many locum shifts have you
29 worked? _____

30
31 Over the past month, roughly how often have you left more than 15 minutes late following a clinical shift?
32

- 33 Rarely
34 A few times a month
35 Once a week
36 A few times a week
37 Everyday

38
39 Over the past month, how often have you taken your full entitlement of breaks during a clinical shift?
40

- 41 Rarely
42 A few times a month
43 Once a week
44 A few times a week
45 Everyday

46
47 What proportion would you say you spend working 'out of hours' (evenings, nights or weekends)?
48

- 49 < 25%
50 26-50%
51 51-75%
52 76-100%

53
54 What proportion of your locum shifts would you say you spend working 'out of hours' (evenings, nights or weekends)?
55

- 56 < 25%
57 26-50%
58 51-75%
59 76-100%

1 I have been able to request and take the annual leave I wanted?
2

- 3 Strongly disagree
- 4 Disagree
- 5 Neutral
- 6 Agree
- 7 Strongly agree

9 I have been able to request and take the study leave I wanted?
10

- 11 Strongly disagree
- 12 Disagree
- 13 Neutral
- 14 Agree
- 15 Strongly agree

17 Over the past month, roughly how often have you found yourself feeling overwhelmed with work during a clinical
18 shift?
19

- 20 Rarely
- 21 A few times a month
- 22 Once a week
- 23 A few times a week
- 24 Everyday

26 Do you consider yourself to have any long-term health conditions or disability?
27

- 28 Yes
- 29 No
- 30 Prefer not to say

32 Do you have significant caring responsibilities outside of work?
33 (e.g. parent or main carer for a relative)
34

- 35 Yes
- 36 No
- 37 Prefer not to say

39 I feel at high risk of burnout from my job in the near future?
40

- 41 Yes
- 42 No
- 43 Prefer not to say

46 I feel I am currently suffering burnout from work?
47

- 48 Yes
 - 49 No
 - 50 Prefer not to say
- 51
52
53
54
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TIRED Site Survey

Department Demographics

Name of emergency department and NHS trust?

Number of attendances per year?

Any specialist designation?

- Trauma unit
 Adult major trauma centre
 Stroke centre
 PCI centre
 Paediatric major trauma centre

Number of EM Consultants?

Number of EM Middle Grades (ST4 and above)?

Number of EM Middle grade career clinicians equivalent to > ST4 (eg associate specialist, specialty doctors, CESR or other non-training doctors)?

Number of EM trainees ST3?

Number of ACCS trainees ST1-2?

Number of GP trainees ST1-3?

Number of ED GPs?

Number of Clinical Fellows (Fy1-ST3)?

Number of Clinical Fellows (>=ST4)?

Number of FY2s?

Number of FY1s?

Total number of ED Doctors calculated from the answers above:

1 Out of the total number of doctors above, how many
2 will be ineligible for the study due to absence
3 during the study period? (eg maternity, sick or
4 annual leave) _____
5

6 What percentage of eligible EM doctors do you
7 estimate you will enrol in the survey? (ie if you
8 have 50 doctors and think you will enrol 25 at your
9 site, that would be 50%).

_____ (We are aiming for a response rate of 80% of
eligible doctors as a minimum at each site but
understand this not might be achievable.
Therefore, this is an opportunity to document how
many you think will be achievable at your site.)

14 Number of advanced nurse practitioners? _____
15
16

18 Number of advanced clinical practitioners? _____
19
20

21 Number of adult qualified EM nurses? _____
22
23

24 Number of paediatric qualified EM nurses? _____
25
26

28 Number of health care assistants (or equivalent)? _____
29
30

31 Number of EM physician associates? _____
32
33

34 Does your Consultant rota use self-rostering?

- Yes
- No

38 Does your Registrar rota use self-rostering?

- Yes
- No

41 Does your SHO rota use self-rostering?

- Yes
- No

What are the current vacancy rates for permanent staff in the following roles?

	0-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91-100%
EM consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM medical staff (excluding Consultants)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM nursing staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-medical staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What percentage of patients were seen within 4 hours in April 2019?

What percentage of patients were seen within 4 hours in March 2019?

What percentage of patients were seen within 4 hours in February 2019?

What percentage of patients were seen within 4 hours in January 2019?

What percentage of patients were seen within 4 hours in December 2018?

What percentage of patients were seen within 4 hours in November 2018?

1
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60

What are the current sickness rates for the following staff groups?

	0-1%	1-2%	2-3%	3-4%	4-5%	5-6%	6-7%	7-8%	8-9%	9-10%	>10%
EM Consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Medical Staff (excluding Consultants)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Nursing staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-Medical Staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All Staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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What is the Minimum Shift Length for the below groups of staff?

	6 hours	7 hours	8 hours	9 hours	10 hours	11 hours	12 hours	13 hours	N/A
EM Consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Trainees, ST4 and above	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Non-training, ST4 and above	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Trainees ST3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ACCS Trainees ST1-2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GP Trainees ST1-3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clinical Fellows (FY1- ST3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clinical Fellows (>= ST4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fy2 Doctors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fy1 Doctors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For peer review only

What is the maximum shift length for the following groups of staff

	6 hours	7 hours	8 hours	9 hours	10 hours	11 hours	12 hours	13 hours	>13 hours	N/A
EM Consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Trainees, ST4 and above	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Non-trainees, ST4 and above	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Trainees, ST3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ACCS Trainees ST1-2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GP Trainees, ST1-3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clinical Fellows (FY1 - ST3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clinical Fellows (=>ST4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fy2 Doctors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fy1 Doctors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For peer review only

How many hours are each of the shifts on your SHO rota?**(Select multiple if this changes depending on the shift)**

	< 8 hours	8 hours	9 hours	10 hours	11 hours	12 hours	>12 hour
Day shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Night shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Twilight shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Day shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Night shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Twilight shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

For peer review only

How many hours are each of the shifts on your registrar rota?
(Select multiple if this changes depending on the shift)

	< 8 hours	8 hours	9 hours	10 hours	11 hours	12 hours	>12 hour
Day shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Night shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Twilight shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Day shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Night shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Twilight shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

For peer review only

How many hours are each of the shifts on your Consultant rota?

	< 8 hours	8 hours	9 hours	10 hours	11 hours	12 hours	>12 hour
Day shift (week)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Night shift (week)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Twilight shift (week)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Day shift (weekend)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Night shift (weekend)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Twilight shift (weekend)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Is there readily available rest facilities available for post night shifts? Yes
 No

Do people know how to access them? Yes
 No

Is there a break room available? Yes
 No

Online Supplementary Material 3
Table of Additional Participant Characteristics

Characteristic	N (%)	NFR Score	
		Median (95% CI) ¹	[LQ - UQ]
Maximum number of consecutive day shifts you would be scheduled to work			
0	30 (0.7)	63.6 (50.1 to 77.2)	[36.4 - 90.9]
1	42 (1.0)	59.1 (40.9 to 77.3)	[27.3 - 90.9]
2	217 (5.3)	63.6 (55.1 to 72.2)	[36.4 - 81.8]
3	522 (12.7)	63.6 (60.9 to 66.4)	[36.4 - 81.8]
4	788 (19.2)	63.6 (63.6 to 63.6)	[45.5 - 81.8]
5	1108 (27)	72.7 (70.0 to 75.5)	[45.5 - 81.8]
6	309 (7.5)	72.7 (66.9 to 78.6)	[54.5 - 90.9]
7	1094 (26.6)	72.7 (72.7 to 72.7)	[45.5 - 90.9]
Missing	137 (3.3)	72.7 (65.7 to 79.7)	[50.0 - 90.9]
Maximum number of consecutive Twilight shifts you would be scheduled to work			
0	339 (8.2)	54.5 (48.3 to 60.8)	[36.4 - 81.8]
1	341 (8.3)	60.0 (51.2 to 68.8)	[36.4 - 81.8]
2	496 (12.1)	54.5 (49.9 to 59.2)	[36.4 - 81.8]
3	796 (19.4)	63.6 (55.8 to 71.5)	[45.5 - 81.8]
4	1100 (26.7)	72.7 (69.9 to 75.5)	[45.5 - 90.9]
5	600 (14.6)	72.7 (72.1 to 73.4)	[54.5 - 90.9]
6	107 (2.6)	72.7 (67.6 to 77.8)	[54.5 - 90.9]
7	334 (8.1)	81.8 (74.4 to 89.3)	[54.5 - 90.9]
Missing	134 (3.3)	72.7 (67.3 to 78.1)	[54.5 - 90.9]
Maximum number of consecutive night shifts you would be scheduled to work			
0	1057 (25.6)	54.5 (52.0 to 57.1)	[27.3 - 80.0]
1	123 (3.0)	63.6 (53.2 to 74.0)	[36.4 - 90.9]
2	153 (3.7)	54.5 (44.7 to 64.4)	[45.5 - 81.8]
3	467 (11.3)	72.7 (65.6 to 79.9)	[45.5 - 90.9]
4	2188 (53.1)	72.7 (72.7 to 72.7)	[54.5 - 90.9]
5	64 (1.6)	72.7 (64.4 to 81.1)	[54.5 - 90.9]
6	6 (0.1)	54.5 (NA)	[45.5 - 81.8]
7	63 (1.5)	72.7 (64.4 to 81.1)	[54.5 - 90.9]
Missing	126 (3.1)	72.7 (67.4 to 78.0)	[54.5 - 90.9]
Maximum number of clinical shifts you work in a typical week?			
1	27 (0.7)	63.6 (45.2 to 82.0)	[45.5 - 90.9]
2	63 (1.5)	63.6 (49.2 to 78.1)	[36.4 - 81.8]

3	240 (5.9)	63.6 (58.1 to 69.2)	[36.4 - 81.8]
4	553 (13.5)	63.6 (54.9 to 72.3)	[36.4 - 81.8]
5	1074 (26.2)	63.6 (62.1 to 65.2)	[45.5 - 81.8]
6	858 (20.9)	72.7 (72.0 to 73.4)	[45.5 - 90.9]
7	1285 (31.3)	72.7 (72.7 to 72.7)	[45.5 - 90.9]
Missing	147 (3.6)	72.7 (67.1 to 78.3)	[45.5 - 90.9]
Non-clinical shifts past month			
0	1164 (28.3)	72.7 (72.7 to 72.7)	[54.5 - 90.9]
<1	394 (9.6)	72.7 (72.1 to 73.4)	[54.5 - 90.9]
1	525 (12.8)	72.7 (72.7 to 72.7)	[50.0 - 90.9]
2	527 (12.8)	63.6 (57.3 to 70.0)	[45.5 - 81.8]
3	242 (5.9)	63.6 (55.1 to 72.2)	[40.0 - 81.8]
4	525 (12.8)	60.0 (51.5 to 68.5)	[36.4 - 81.8]
5	115 (2.8)	54.5 (47.3 to 61.8)	[36.4 - 72.7]
6	124 (3.0)	54.5 (45.6 to 63.5)	[31.7 - 80.9]
7	39 (0.9)	63.6 (43.5 to 83.8)	[36.4 - 81.8]
8	157 (3.8)	54.5 (45.2 to 63.9)	[36.4 - 81.8]
9	19 (0.5)	60.0 (34.6 to 85.4)	[27.3 - 72.7]
10	102 (2.5)	54.5 (45.2 to 63.9)	[36.4 - 80.0]
11-15	86 (2.1)	54.5 (44.7 to 64.4)	[27.3 - 72.7]
>15	91 (2.2)	63.6 (47.6 to 79.7)	[27.3 - 81.8]
Missing	137 (3.3)	72.7 (66.6 to 78.9)	[54.5 - 90.9]
Average commute in minutes			
1-10	396 (9.6)	72.7 (64.2 to 81.3)	[45.5 - 81.8]
11-20	814 (19.8)	72.7 (64.6 to 80.9)	[45.5 - 90.0]
21-30	967 (23.5)	72.7 (64.6 to 80.8)	[45.5 - 90.9]
31-40	703 (17.1)	63.6 (63.6 to 63.6)	[36.4 - 81.8]
41-50	546 (13.3)	72.7 (64.5 to 81.0)	[45.5 - 90.9]
51-60	365 (8.9)	72.7 (67.6 to 77.8)	[45.5 - 90.0]
>60	325 (7.9)	72.7 (66.9 to 78.5)	[45.5 - 90.9]
Missing	131 (3.2)	72.7 (68.4 to 77.1)	[54.5 - 90.9]
Do you have a dedicated time away from adult emergency medicine?			
No	3091 (75.2)	72.7 (67.2 to 78.3)	[45.5 - 90.9]
Yes	1020 (24.8)	63.6 (62.2 to 65.1)	[36.4 - 81.8]
Missing	136 (3.3)	72.7 (67.7 to 77.8)	[45.5 - 90.9]

Frequency and percentage, median NFR score with 95% bootstrapped confidence intervals and the inter-quartile range of participants within each category.

¹ Bootstrapped 95% confidence intervals based on 1000 replications on a minimum of 8 observations.

Online Supplementary Material 4

Summary of median quantile regression model fitted to the Need for Recovery (NFR) score with fixed effects for site, including the adjusted coefficient estimate (Adj. Coef. Est.) with corresponding 95% confidence interval (CI) and p-value.

	Adj. Coeff. Est. (95% CI)	P-value¹
Constant (baseline NFR score)	59.51 (55.53 to 63.49)	< 0.001
Gender (baseline = Male)		
• Female	3.38 (1.80 to 4.95)	< 0.001
• Other/Prefer not to say	-0.10 (-7.84 to 7.64)	0.979
Any long-term health conditions or disabilities (baseline = No)		
• Yes	8.33 (5.73 to 10.93)	< 0.001
• Prefer not to say	6.10 (1.78 to 10.43)	0.006
ED paediatrics only? (baseline = No)		
• Yes	-8.47 (-12.97 to -3.98)	< 0.001
Clinical grade (baseline = Foundation)		
• ST1-ST2	-0.20 (-2.55 to 2.16)	0.869
• > ST2	1.04 (-1.49 to 3.57)	0.421
• SASG	-1.20 (-4.32 to 1.92)	0.450
• GP	-7.33 (-15.49 to 0.83)	0.078
• Consultant	-4.94 (-7.72 to -2.17)	< 0.001
I have been able to request and take study when I wanted (baseline = Neutral)		
• Strongly disagree	3.45 (-0.19 to 7.10)	0.063
• Disagree	3.57 (0.53 to 6.61)	0.022
• Agree	-1.18 (-3.36 to 1.00)	0.290
• Strongly agree	-6.32 (-9.23 to -3.41)	< 0.001
I have been able to request and take annual when I wanted (baseline = Neutral)		
• Strongly disagree	6.42 (2.69 to 10.15)	0.001
• Disagree	1.37 (-1.73 to 4.47)	0.385
• Agree	-2.60 (-5.07 to -0.13)	0.039
• Strongly agree	-4.31 (-7.33 to -1.28)	0.005
Proportion of time spent working out of hours (baseline = 0-25%)		
• 26-50%	5.96 (3.16 to 8.76)	< 0.001
• 51-75%	10.39 (7.54 to 13.25)	< 0.001
• 76-100%	14.34 (10.92 to 17.75)	< 0.001

Need for recovery amongst Emergency Physicians in the United Kingdom and Ireland: Findings from a Trainee Emergency Research Network (TERN) survey study

Research Checklist: The Checklist for Reporting Results of Internet E-Surveys (CHERRIES)

CHERRIES CHECKLIST ADAPTED FROM:			
Eysenbach, Gunther. "Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES)." <i>Journal of medical Internet research</i> vol. 6,3 e34. 29 Sep. 2004, doi:10.2196/jmir.6.3.e34			
Item Category	Checklist Item	Explanation	Checklist Response
IRB (Institutional Review Board) approval and informed consent process	Describe survey design	Describe target population, sample frame. Is the sample a convenience sample? (In "open" surveys this is most likely.)	Outlined in 'Methods'
	IRB approval	Mention whether the study has been approved by an IRB.	Outlined in 'Ethics Approval'
	Informed consent	Describe the informed consent process. Where were the participants told the length of time of the survey, which data were stored and where and for how long, who the investigator was, and the purpose of the study?	Outlined in Survey Distribution, monitoring and recruitment
	Data protection	If any personal information was collected or stored, describe what mechanisms were used to protect unauthorized access.	Outlined in Survey Distribution, monitoring and recruitment
Development and pre-testing	Development and testing	State how the survey was developed, including whether the usability and technical functionality of the electronic questionnaire had been tested before fielding the questionnaire.	Outlined in 'Survey Development'
Recruitment process and description of the sample having access to the questionnaire	Open survey versus closed survey	An "open survey" is a survey open for each visitor of a site, while a closed survey is only open to a sample which the investigator knows (password-protected survey).	Outlined in Survey Distribution, monitoring and recruitment
	Contact mode	Indicate whether or not the initial contact with the potential participants was made on the Internet. (Investigators may also send out questionnaires by mail and allow for Web-based data entry.)	Outlined in 'Survey Distribution, monitoring and recruitment'
	Advertising the survey	How/where was the survey announced or advertised? Some examples are offline media (newspapers), or online (mailing lists – If yes, which ones?) or banner ads (Where were these banner ads posted and what did they look like?). It is important to know the wording of the announcement as it will heavily influence who chooses to participate. Ideally the survey	Outlined in 'Survey Distribution, monitoring and recruitment'

		announcement should be published as an appendix.	
Survey administration	Web/E-mail	State the type of e-survey (eg, one posted on a Web site, or one sent out through e-mail). If it is an e-mail survey, were the responses entered manually into a database, or was there an automatic method for capturing responses?	<i>Outlined in 'Survey Distribution, monitoring and recruitment'</i>
	Context	Describe the Web site (for mailing list/newsgroup) in which the survey was posted. What is the Web site about, who is visiting it, what are visitors normally looking for? Discuss to what degree the content of the Web site could pre-select the sample or influence the results. For example, a survey about vaccination on a anti-immunization Web site will have different results from a Web survey conducted on a government Web site	<i>Outlined in 'Design'</i>
	Mandatory/voluntary	Was it a mandatory survey to be filled in by every visitor who wanted to enter the Web site, or was it a voluntary survey?	<i>Outlined in 'Survey Distribution, monitoring and recruitment'</i>
	Incentives	Were any incentives offered (eg, monetary, prizes, or non-monetary incentives such as an offer to provide the survey results)?	No
	Time/Date	In what timeframe were the data collected?	<i>Outlined in 'Sites and settings'</i>
	Randomization of items or questionnaires	To prevent biases items can be randomized or alternated.	<i>Not done</i>
	Adaptive questioning	Use adaptive questioning (certain items, or only conditionally displayed based on responses to other items) to reduce number and complexity of the questions	<i>Outlined in Survey Distribution, monitoring and recruitment</i>
	Number of Items	What was the number of questionnaire items per page? The number of items is an important factor for the completion rate.	<i>Outlined in 'Design'</i>
	Number of screens (pages)	Over how many pages was the questionnaire distributed? The number of items is an important factor for the completion rate.	<i>Outlined in 'Design'</i>
	Completeness check	It is technically possible to do consistency or completeness checks before the questionnaire is submitted. Was this done, and if "yes", how (usually JavaScript)? An alternative is to check for completeness after the questionnaire has been submitted (and highlight mandatory items). If this has been done, it should be reported. All items should provide a non-response option such as "not applicable" or	<i>Not done</i>

		"rather not say", and selection of one response option should be enforced.	
	Review step	State whether respondents were able to review and change their answers (eg, through a Back button or a Review step which displays a summary of the responses and asks the respondents if they are correct).	<i>Outlined in Survey Distribution, monitoring and recruitment</i>
Response rates	Unique site visitor	If you provide view rates or participation rates, you need to define how you determined a unique visitor. There are different techniques available, based on IP addresses or cookies or both.	<i>Outlined in 'Results'</i>
	View rate (Ratio of unique survey visitors/unique site visitors)	Requires counting unique visitors to the first page of the survey, divided by the number of unique site visitors (not page views!). It is not unusual to have view rates of less than 0.1 % if the survey is voluntary	<i>Survey site contains first page of survey therefore N/A</i>
	Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)	Count the unique number of people who filled in the first survey page (or agreed to participate, for example by checking a checkbox), divided by visitors who visit the first page of the survey (or the informed consents page, if present). This can also be called "recruitment" rate.	<i>Outlined in 'Results'</i>
	Completion rate (Ratio of users who finished the survey/users who agreed to participate)	The number of people submitting the last questionnaire page, divided by the number of people who agreed to participate (or submitted the first survey page). This is only relevant if there is a separate "informed consent" page or if the survey goes over several pages. This is a measure for attrition. Note that "completion" can involve leaving questionnaire items blank. This is not a measure for how completely questionnaires were filled in. (If you need a measure for this, use the word "completeness rate".)	<i>Outlined in 'Results'</i>
Preventing multiple entries from the same individual	Cookies used	Indicate whether cookies were used to assign a unique user identifier to each client computer. If so, mention the page on which the cookie was set and read, and how long the cookie was valid. Were duplicate entries avoided by preventing users access to the survey twice; or were duplicate database entries having the same user ID eliminated before analysis? In the latter case, which entries were kept for analysis (eg, the first entry or the most recent)?	<i>Not used</i>
	IP check	Indicate whether the IP address of the client computer was used to identify potential duplicate entries from the same user. If so, mention the period of	<i>Not used due to survey being completed on multi-user/single log-in computers</i>

		time for which no two entries from the same IP address were allowed (eg, 24 hours). Were duplicate entries avoided by preventing users with the same IP address access to the survey twice; or were duplicate database entries having the same IP address within a given period of time eliminated before analysis? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	
	Log file analysis	Indicate whether other techniques to analyze the log file for identification of multiple entries were used. If so, please describe.	Not done
	Registration	In "closed" (non-open) surveys, users need to login first and it is easier to prevent duplicate entries from the same user. Describe how this was done. For example, was the survey never displayed a second time once the user had filled it in, or was the username stored together with the survey results and later eliminated? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	N/A
Analysis	Handling of incomplete questionnaires	Were only completed questionnaires analyzed? Were questionnaires which terminated early (where, for example, users did not go through all questionnaire pages) also analyzed?	Outlined in 'Data Analysis'
	Questionnaires submitted with an atypical timestamp	Some investigators may measure the time people needed to fill in a questionnaire and exclude questionnaires that were submitted too soon. Specify the timeframe that was used as a cut-off point, and describe how this point was determined	N/A
	Statistical correction	Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for the non-representative sample; if so, please describe the methods.	Outlined in 'Data Analysis'

BMJ Open

Need for recovery amongst Emergency Physicians in the United Kingdom and Ireland: a cross-sectional survey

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Primary Subject Heading:	Emergency medicine
Secondary Subject Heading:	Medical management, Occupational and environmental medicine, Health services research
Keywords:	ACCIDENT & EMERGENCY MEDICINE, HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Human resource management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisation of health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, OCCUPATIONAL & INDUSTRIAL MEDICINE

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1 **Need for recovery amongst Emergency Physicians in the United**
2 **Kingdom and Ireland: a cross-sectional survey**

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40 The list of Trainee Emergency Research Network and Paediatric Emergency
41 Research in the UK and Ireland collaborators is included at the end of the
42 statements section.

43

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62 Figures: 2

63 Tables: 4

64

65 **Keywords:** Emergency Medicine; Human resource management;

66 Organisation of health services; Occupational and Industrial medicine.

67

1
2
3 68 **ABSTRACT**
4

5 69 **Objectives:** To determine the need for recovery (NFR) among Emergency
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8 70 Physicians and to identify demographic and occupational characteristics
9
10 71 associated with higher NFR scores.

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12 72 **Design:** Cross-sectional electronic survey.

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14 73 **Setting:** Emergency Departments (ED) (n=112) in the United Kingdom and
15
16
17 74 Ireland.

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19 75 **Participants:** Emergency Physicians, defined as any registered physician
20
21 76 working principally within the ED, responding between June-July 2019.

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23 77 **Main outcome measure:** NFR scale, an 11-item self-administered
24
25 78 questionnaire that assesses how work demands affect inter-shift recovery.

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27 79 **Results:** The median NFR score for all 4247 eligible, consented participants
28
29 80 with a valid NFR score was 70.0 (95% CI: 65.5 to 74.5), with an IQR of 45.5–
30
31 81 90.0. A linear regression model indicated statistically significant associations
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33 82 between gender, health conditions, type of ED, clinical grade, access to
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35 83 annual and study leave, and time spent working out-of-hours. Groups
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37 84 including male physicians, consultants, General Practitioners within the ED,
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39 85 those working in paediatric EDs and those with no long-term health condition
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41 86 or disability had a lower NFR score. After adjusting for these characteristics,
42
43 87 the NFR score increased by 3.7 (95% CI: 0.3 to 7.1) and 6.43 (95% CI: 2.0 to
44
45 88 10.8) for those with difficulty accessing annual and study leave, respectively.
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47 89 Increased percentage of out-of-hours work increased NFR score almost
48
49 90 linearly: 26-50% out-of-hours work = 5.7 (95% CI: 3.1 to 8.4); 51-75% out-of-
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51 91 hours work = 10.3 (95% CI: 7.6 to 13.0); 76-100% out-of-hours work = 14.5
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57 92 (95% CI: 11.0 to 17.9).
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3 93 **Conclusion:** Higher NFR scores were observed among Emergency
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5 94 Physicians than reported in any other profession or population to date. Whilst
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7 95 out-of-hours working is unavoidable, the linear relationship observed suggests
8
9 96 that any reduction may result in NFR improvement. Evidence-based
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11 97 strategies to improve well-being such as proportional out-of-hours working
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13 98 and improved access to annual and study leave should be carefully
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15 99 considered and implemented where feasible.
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3 118 **ARTICLE SUMMARY**

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6 120 **Strengths and limitations of this study**

- 7 121
8 122
9 123 • This is the first study evaluating the need for recovery (NFR) scale within a
10
11 large healthcare population.
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16 126 • The inclusion of responses from over half of all UK Emergency
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18 Departments indicates the results are likely to be generalisable.
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23 129 • The high volume of responses, with over half of study sites exceeding 70%
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25 participant response rates, indicates that the NFR scale is an acceptable
26 130
27 measurement tool for physicians.
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30 132
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32 133 • The study is limited by the single-point of time measurement therefore
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34 seasonal bias cannot be excluded and further assessment of test-retest
35 134
36 reliability is desirable.
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41 137 • The use of self-administered dichotomous questionnaires is acknowledged
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43 to limit wider insights into physician recovery and well-being.
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139 INTRODUCTION

140 Recruitment and retention challenges in acute care pose a significant and
141 ongoing threat to effective healthcare provision. The need to maintain a healthy
142 and sustainable workforce is vital to safeguard future services.[1] Physician
143 well-being is a key influence on retention, with low job satisfaction and high
144 levels of stress directly leading to concern over job sustainability.[2–4] Globally,
145 high rates of physician burnout are increasingly recognised, along with the
146 consequent negative impact on delivery of high quality patient care.[5–10]

147 The Need for Recovery (NFR) scale measures the subjective perception
148 of the need to recuperate from physical and mental demands of a working day,
149 and is a suitable tool with which to assess the early symptoms of fatigue in shift
150 workers.[11,12] Within unscheduled care settings such as emergency
151 medicine, shift work is often of high intensity, and additional factors such as
152 department crowding, pressured resources and inability to control patient
153 volume may also influence NFR. Where fatigue does occur and cannot be
154 sufficiently recovered between shifts, the effect is cumulative and may lead to
155 increased occupational stress and impaired long-term health.[13,14]

156
157 Burnout inventories are increasingly utilised as an attempt to measure
158 physician well-being.[15] Although they provide valuable insight into well-
159 being, they are not without issue. Limitations include variability in burnout
160 definitions, time required for completion, ease of completion, respondent
161 survey fatigue, and difficulty translating results into intervention.[16,17,18]
162 Additionally, these methods quantify established burnout; once this has
163 occurred the human and financial resource impact is already immense, with

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3 164 associated workforce depletion and negligible mitigation strategies.[19,20]
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5 165 The identification of those clinicians *at risk* of burnout, at an early timepoint
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7 166 when interventions may be effective, presents a critical challenge.
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12 168 Increasing NFR is associated with the likelihood of progression to
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14 169 occupational burnout and health complaints, with negative effects cumulative
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16 170 over time in several validation studies [11,13]. Increased NFR may therefore
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18 171 precede the onset of sustained occupational burnout, and offer advantages
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20 172 over other burnout inventories as a simple quantifiable metric obtained through
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22 173 a rapid, standalone, and repeatable 11-item questionnaire. A single centre
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24 174 study assessing the utility of the NFR in an ED population reported a high
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26 175 response rate (80%) and completion time of less than 10 minutes whilst gaining
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28 176 insight into shift patterns, work-life balance and well-being (21). This might
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30 177 suggest that the method of questioning used in the NFR scale and emphasis
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32 178 on recovery as opposed to more emotive questioning could be beneficial in
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34 179 improving response rates and reducing respondent fatigue in repeat usage. As
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36 180 such, NFR may provide a valuable option for regular evaluating of staff well-
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38 181 being and identifying opportunity for early intervention in busy EDs. Staff well-
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40 182 being is the fourth highest Emergency Medicine (EM) Research Priority
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42 183 identified by the James Lind Alliance Priority Setting Partnership, involving
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44 184 patients, carers and physicians.[22].
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49 186 We therefore aimed to determine the NFR among Emergency
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51 187 Physicians in EDs in the UK and Ireland, and identify demographic and
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53 188 occupational characteristics associated with higher NFR scores that might
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3 189 allow for early targeted intervention to improve physicians' well-being and
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5 190 reduce burnout.
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10 192 **METHODS**

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12 193 This cross-sectional electronic survey study targeted a representative sample
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14 194 of Emergency Physicians working across the UK and Ireland, and was
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16 195 performed and reported in line with the Checklist for Reporting Results of
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18 196 Internet E-surveys.[23] The study was registered at ISRCTN
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20 197 (<https://doi.org/10.1186/ISRCTN21869845>). Ethical approval was obtained
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22 198 from the UK Health Research Authority (Reference: 19/HRA/2404) alongside
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24 199 equivalent approvals in Scotland, Northern Ireland and Ireland.
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31 201 **Settings and Participants**

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33 202 An initial sample of 100 EDs was deemed necessary to ensure inclusion of
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35 203 greater than 50% of Type 1 EDs, defined as 'an EM consultant-led 24-hour
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37 204 service with full resuscitation facilities', in England. [24] The study was
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39 205 coordinated via the UK Trainee Emergency Research Network (TERN) and
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41 206 delivered in collaboration with Paediatric Emergency Research in the UK and
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43 207 Ireland (PERUKI) and Ireland TERN. [25, 26] Signposting to the survey and
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45 208 enrolment of participants was led by site principal investigators (PI), who were
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47 209 provided with standardised study documentation. Local and national promotion
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49 210 of the study was conducted at professional meetings, through social media,
50
51 211 national newsletters, and using the Clinical Research Network infrastructure.
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56 212 Physicians of any grade who were registered with either the UK General
57
58 213 Medical Council or Irish Medical Council, and who were employed within a
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1
2
3 214 participating ED, were invited to participate. For the purposes of this study, the
4
5 215 term Emergency Physician is defined as all doctors working within the ED. This
6
7 216 included; doctors specialising in EM, comprising six years of postgraduate
8
9 217 training for full qualification to achieve the grade of Emergency Medicine
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11 218 consultant, or non-EM specialists undertaking rotations in the ED as part of their
12
13 219 professional training, including those in the first and second year of
14
15 220 postgraduate training and physicians undertaking training in General Practice,
16
17 221 Anaesthesia and Acute Medicine who commonly undertake a four to six month
18
19 222 ED rotation (Online Supplementary Material 1). Physicians who did not hold a
20
21 223 permanent contract with a participating hospital (such as those working ad-hoc
22
23 224 locum shifts), those on leave during the study period, and those in a non-clinical
24
25 225 role were excluded.

226 **Survey Development**

227 The NFR scale consists of 11 items each requiring a dichotomous 'yes' or 'no'
228 response, originally developed as a subscale of the Dutch Questionnaire on the
229 Experience and Evaluation of Work (QEEW) (Online Supplementary material
230 2, page 10).[27] Indicators of fatigue such as reduced motivation for activities
231 and concentration at the end of a working day are assessed to measure the
232 effect of work demands experienced. A 'yes' response to an item, with the
233 exception of question four which is reversed, signals an unfavourable situation.
234 The 11 items are then summated to give an overall score between 0 and 100,
235 with a higher score denoting a greater NFR and increased short-term work-
236 related fatigue. The NFR has previously been demonstrated to have an overall
237 Cronbach's alpha of 0.88, a measure of internal consistency and questionnaire
238 reliability, with a range of 0.81 to 0.92 in subgroup analyses of the same

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3 239 validation study.[28] Following a minor amendment to one question to increase
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5 240 applicability to the study population (from 'After the evening meal, I generally
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7 241 feel in good shape' to 'After my breaks I feel fresh to continue my work'),
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9
10 242 feasibility work in a single UK centre demonstrated a Cronbach's alpha of 0.79,
11
12 243 and found that the NFR scale was acceptable and user-friendly. [21]
13

14 244 A patient and public involvement (PPI) consultation was conducted at
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16
17 245 the UK Emergency Medicine Trainee Association Conference (Cardiff,
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19 246 December 2018), using a semi-structured question guide for mixed focus
20
21 247 groups to review a proposed participant survey. A key element of this
22
23 248 consultation explored the use of a burnout inventory within the proposed study;
24
25 249 concerns relating to respondent fatigue, length of survey and assessment of
26
27 250 questions using a Likert scale indicated that such an inventory was not
28
29 251 universally acceptable to Emergency Physicians. Based on this consultation,
30
31 252 the final participant survey included the 11-item NFR scale used in the feasibility
32
33 253 work and 44-items collecting the participants' demographic, occupational and
34
35 254 perceived well-being characteristics (Online Supplementary Material 2).
36
37 255 Questions relating to 'out-of-hours' work were defined as work outside of
38
39 256 normal working office hours (9am until 5pm, Monday to Friday).
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44 257 A separate site-specific survey was developed de novo with expert input
45
46 258 from experienced EM physicians, consisting of 39-items identified from the
47
48 259 literature and/or consensus of the study team, which explored departmental,
49
50 260 rota pattern and staffing characteristics likely to provide context for analysis and
51
52 261 interpretation of individual survey results (Online Supplementary Material 3).
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54 262 Only one site-specific survey was required per participating centre and was
55
56 263 completed by the site PI.
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264 **Survey Distribution, monitoring and recruitment**

265 All participants were provided with an information sheet, and consented to
266 participation prior to completing the survey; this was voluntary, anonymous, and
267 no incentives were given. Respondents were able to review and change their
268 answers prior to final submission of the survey. Branching logic was used for
269 responses to certain questions. Data were collected during a six-week period
270 from 3rd June 2019. During this period, advertisement of the survey and weekly
271 reminders were sent out via site PIs. The participant and site-specific surveys
272 were open surveys accessed through a link and hosted on a research specific
273 electronic survey platform, Research Electronic Data Capture platform
274 ('REDCap'; University of Bristol), which complies with European General Data
275 Protection Regulations.[29,30]

276 Prior to study commencement, site PIs provided a best estimate of
277 eligible participants which accounted for local physician absence due to
278 sickness, leave, and factors such as sabbaticals and professional
279 secondments. This denominator was used to give a best-estimate of the per-
280 site survey response rate, with a stated aim of achieving a 70% response rate.

281 **Statistical Analysis**

282 Statistical analysis was undertaken using STATA 14. [31] Participants were
283 only included in any of the reported analyses if they were from one of the 112
284 registered sites and provided a response for at least eight of the 11 items of the
285 NFR scale as per imputation guidelines. Imputation was performed by replacing
286 missing items with the mean of all completed item responses. [32]

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3 287 As one item in the NFR scale was amended due to applicability to the
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5 288 study population, the internal consistency of the NFR scale for all participants
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8 289 with a valid NFR score was calculated by Cronbach's alpha.
9

10 290 To describe the study sample, the frequency and percentage of
11
12 291 participants by site, demographic and occupational characteristics are reported.
13
14 292 As the distribution of the NFR score in this study was negatively skewed,
15
16
17 293 summary statistics of the median NFR score are reported with corresponding
18
19 294 bootstrapped 95% confidence intervals from 1000 replications (providing there
20
21 295 are at least 8 observations to allow for sufficient number of sample
22
23 296 combinations), and inter-quartile ranges (IQR) of all eligible participants. Box
24
25
26 297 plots were used as visual aids to identify covariates that may have a statistically
27
28 298 significant association with the NFR score and the nature of the relationship.
29

30 299 To facilitate comparisons with previous published literature and given
31
32 300 the large number of participants, we fitted Gaussian, mixed effects, linear
33
34 301 regression models to NFR score, where site was included as a random effect
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36 302 to account for potentially unknown differences between EDs. To identify
37
38 303 statistically significant associations between the NFR score and observed
39
40 304 covariates, the forward model selection procedure was implemented; inclusion
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42 305 in the model was based upon the goodness of fit test at the 5% level of
43
44 306 significance, using only participants with complete NFR score and covariate
45
46 307 data. The final model was estimated using participants with complete data for
47
48 308 the included covariates and NFR score, with the coefficient estimate calculated
49
50 309 by adjusting for all covariates reported in the model. Quantile regression was
51
52 310 used to confirm the direction and significance of the identified associations
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54 311 under non-parametric assumptions.
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313 **RESULTS**

314 Characteristics of the 112 participating sites are presented in table 1.

315 **Table 1: Characteristics of sites registered to take part in the survey study**

Site Characteristics	N (%) Total = 112
Country	
England	89 (79.5)
Wales	3 (2.7)
Northern Ireland	3 (2.7)
Scotland	12 (10.7)
Republic of Ireland	5 (4.4)
ED Annual Attendance	
≤ 50,000	11 (9.8)
50,001 to 100,000	46 (41.1)
>100,000	42 (37.5)
<i>Missing</i>	13 (11.6)
Specialist Designation	
Trauma Unit (TU)	55 (49.1)
Major Trauma Centre (MTC)	25 (22.3)
Stroke Centre	42 (37.5)
PCI Centre	30 (26.8)

316

317 *ED Emergency department*318 *TU In the UK National Health Service, a hospital that provides care for all except the most*
319 *severe major trauma patients. May provide initial stabilisation of severely injured patients prior*
320 *to transfer to an MTC.*321 *MTC A specialist (tertiary) centre responsible for care of the most severely injured patients.*322 *PCI Percutaneous Coronary Intervention*

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325

326 Of 5107 unique visits to the online survey, 4365 of these were registered at one

327 of the 112 sites and provided consent, with 4247 completing at least eight items

328 of the NFR scale. Cronbach's alpha for all participants with a valid NFR score

329 was 0.80. The median NFR score across all eligible participants was 70.0 (95%
 330 CI: 65.5 to 74.5), with an IQR of 45.5 – 90.0. Figure 1 and Figure 2, and tables
 331 2 and 3 present a selection of participant's NFR score by demographic and
 332 occupational characteristics, with additional characteristics presented in the
 333 Online Supplementary Material 4.

334 **Table 2: Summary statistics of NFR score by participant's characteristics.** Frequency
 335 and percentage, median Need for Recovery (NFR) score with 95% bootstrapped confidence
 336 intervals and the inter-quartile range of participants within each category.

Participant Characteristics	N (%)	NFR Score	
		Median (95% CI)	[LQ - UQ]
All participants	4247 (100)	70.0 (62.0 to 78.0)	[45.5 - 90.0]
Length of time worked in current ED (months)			
0 to 3	740 (17.5)	72.7 (71.7 to 73.8)	[45.5 - 90.9]
> 3 to 6	848 (20.0)	72.7 (72.7 to 72.7)	[54.5 - 90.9]
> 6 to 12	729 (17.2)	72.7 (64.7 to 80.7)	[45.5 - 90.9]
> 12 to 24	370 (8.7)	63.6 (58.8 to 68.4)	[45.5 - 90.9]
> 24 to 60	583 (13.8)	63.6 (62.2 to 65.1)	[36.4 - 81.8]
> 60 to 120	497 (11.7)	63.6 (56.7 to 70.5)	[36.4 - 81.8]
> 120	473 (11.2)	54.5 (46.6 to 62.5)	[36.4 - 81.8]
Missing	7 (0.2)	18.2 (NA) ¹	[9.1 - 54.5]
Type of contract			
100%	3445 (83.5)	72.7 (67.1 to 78.4)	[45.5 - 90.9]
90%	72 (1.7)	63.6 (54.0 to 73.3)	[36.4 - 81.8]
80%	200 (4.8)	63.6 (61.4 to 65.8)	[45.5 - 81.8]
70%	116 (2.8)	72.7 (63.6 to 81.9)	[50.0 - 81.8]
60%	142 (3.4)	63.6 (54.4 to 72.9)	[45.5 - 90.9]
50%	85 (2.1)	63.6 (53.5 to 73.7)	[36.4 - 81.8]
< 50%	66 (1.6)	50.0 (35.7 to 64.3)	[27.3 - 81.8]
Missing	121 (2.9)	72.7 (67.8 to 77.7)	[54.5 - 90.9]
Significant caring responsibilities outside of work			
No	2616 (63.6)	72.7 (68.5 to 77.0)	[45.5 - 90.9]
Yes	1427 (34.7)	63.6 (62.8 to 64.5)	[36.4 - 81.8]
Prefer not to say	73 (1.8)	81.8 (71.0 to 92.7)	[54.5 - 90.9]
Missing	131 (3.2)	72.7 (68.2 to 77.3)	[54.5 - 90.9]

337 ¹ Insufficient observations for Bootstrapped 95% confidence intervals based

338
 339 **Table 3: Summary statistics of NFR score by occupational characteristics.** Frequency
 340 and percentage, median Need for Recovery (NFR) score with 95% bootstrapped confidence
 341 intervals and the inter-quartile range of participants within each category.

Occupational	N (%)	NFR Score
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Characteristics		Median (95% CI) ¹	[LQ - UQ]
All participants	4247 (100)	70.0 (62.0 to 78.0)	[45.5 - 90.0]
scheduled weekend work frequency			
1 in 2	1479 (36.0)	72.7 (72.3 to 73.2)	[54.5 - 90.9]
1 in 3	865 (21.1)	72.7 (68.1 to 77.4)	[45.5 - 90.9]
1 in 4	542 (13.2)	63.6 (57.1 to 70.2)	[45.5 - 81.8]
1 in 5	310 (7.5)	54.5 (48.4 to 60.7)	[36.4 - 81.8]
1 in 6	485 (11.8)	54.5 (49.8 to 59.3)	[27.3 - 81.8]
< 1 in 6	307 (7.5)	63.6 (55.2 to 72.1)	[36.4 - 81.8]
None	121 (2.9)	54.5 (45.7 to 63.4)	[27.3 - 81.8]
Missing	138 (3.4)	72.7 (65.9 to 79.6)	[45.5 - 90.9]
Maximum number of consecutive clinical shifts scheduled to work			
1	52 (1.3)	63.6 (45.1 to 82.2)	[27.3 - 90.9]
2	190 (4.6)	54.5 (47.6 to 61.5)	[27.3 - 72.7]
3	465 (11.3)	63.6 (60.3 to 67.0)	[36.4 - 81.8]
4	783 (19)	63.6 (63.0 to 64.3)	[45.5 - 81.8]
5	827 (20.1)	72.7 (66.2 to 79.3)	[45.5 - 81.8]
6	389 (9.5)	72.7 (67.3 to 78.2)	[45.5 - 90.0]
7	855 (20.8)	72.7 (70.8 to 74.6)	[45.5 - 90.9]
8	554 (13.5)	72.7 (66.5 to 78.9)	[54.5 - 90.9]
Missing	132 (3.2)	72.7 (67.9 to 77.6)	[54.5 - 90.9]

¹ Bootstrapped 95% confidence intervals based on 1000 replications on a minimum of 8 observations.

Only 7.5% of the participants were aged over 50 years, and the majority were aged between 26 and 30 years (28.6%). NFR score appeared to decrease with age, such that those in age groups 20 to 35 years all had a median score of 72.7, age groups 36 to 55 had a median score of 63.6, and those over 55 years had a median score of 54.5 (figure 1a). There was a reasonable balance between males and females, with just over 1% who did not submit a response (missing), preferred not to say or other. Females had a higher median NFR score of 72.7 (95% CI: 70.5 to 75.0) compared with males 63.6 (95% CI: 60.8 to 66.5) (figure 1b). Within clinical grade, consultants accounted for over a quarter of the participants who (with GPs) had the lowest median NFR score of 54.5 (consultants 95% CI: 53.6 to 55.5) compared with 72.7 in all other grades (figure 1c). The majority of participants had no long-term health conditions or

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2
3 357 disability (88.6%), with a lower NFR score of 63.6 (95% CI 60.2 to 67.1)
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5 358 compared with those who did report a long-term health condition or disability
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7 359 72.7 (95% CI: 66.2 to 79.2) (figure 1d). Most participants worked full time
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9 360 (83.5%), but overall, the NFR score did not decrease as contract proportion
10
11 361 decreased (table 2). Over half (54.6%) had been working in their current ED for
12
13 362 1 year or less and generally had higher NFR scores compared to those present
14
15 363 for over 1 year. Less than 35% of participants declared significant caring
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17 364 responsibilities outside of work, but those who do had a lower median NFR
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19 365 score (63.6, 95% CI: 62.8 to 64.5) than those who did not (72.7, 95% CI: 68.5
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21 366 to 77.0).
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27 367 Most of the participants agreed or strongly agreed they were able to
28
29 368 obtain study or annual leave when requested (68% and >73%, respectively).
30
31 369 As the ability to obtain study and annual leave on request increased, the NFR
32
33 370 score decreased from 81.8 (95% CI: 81.4 to 82.2) to 54.5 (95% CI: 49.4 to 59.7)
34
35 371 for study leave and 81.8 (95% CI: 76.4 to 87.2) to 60.0 (95% CI: 51.8 to 68.2)
36
37 372 for annual leave (figures 2a and 2b). There was evidence the NFR score
38
39 373 increased as the proportion of time working out-of-hours increased, from 54.5
40
41 374 (95% CI: 47.8 to 61.3) to 81.8 (95% CI: 75.4 to 88.3) (figure 2c). Over 75% of
42
43 375 participants spent the majority of their time in adult EM with a median NFR
44
45 376 score of 72.7 for mixed or adult only, which was higher when compared with
46
47 377 paediatrics only 63.6 (95% CI: 55.2 to 72.1) (figure 2d). Most participants
48
49 378 worked 1 in 2 weekends (36%) with a median NFR score of 72.7, which
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51 379 decreased to 54.5 for those who did not work any weekend shifts (see table 3).
52
53 380 Over 50% reported working 5 to 8 consecutive clinical shifts and had a median
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381 NFR score of 72.7, compared with those who worked less than five who had a
382 median NFR \leq 63.6.

383 The summary statistics of the final regression model are presented in
384 table 4.

385 **Table 4: Summary of final Gaussian, mixed effects, linear regression model fitted to the**
386 **Need for Recovery (NFR) score, including the adjusted coefficient estimate (Adj. Coef.**
387 **Est.) with corresponding 95% confidence interval (CI) and p-value.**

	Adj. Coeff. Est. (95% CI) ¹	P-value ²
Constant (baseline NFR score)	59.51(55.53 to 63.49)	< 0.001
Gender (baseline = Male)		
• Female	3.40(1.80 to 4.99)	< 0.001
• Other/Prefer not to say	-0.46(-9.07 to 8.15)	0.916
Any long-term health conditions or disabilities (baseline = No)		
• Yes	8.52(5.67 to 11.36)	< 0.001
• Prefer not to say	6.24(1.52 to 10.95)	0.01
ED paediatrics only? (baseline = No)		
• Yes	-7.08(-10.4 to -3.77)	< 0.001
Clinical grade (baseline = Foundation)		
• ST1-ST2	-0.08(-2.67 to 2.51)	0.953
• > ST2	1.32(-1.37 to 4.01)	0.336
• SASG	-1.13(-4.27 to 2.02)	0.482
• GP	-8.26(-15.09 to -1.44)	0.018
• Consultant	-5.30(-8.07 to -2.53)	< 0.001
I have been able to request and take study when I wanted (baseline = Neutral)		
• Strongly disagree	4.23(-0.26 to 8.71)	0.065
• Disagree	3.72(0.29 to 7.15)	0.034
• Agree	-1.32(-3.60 to 0.96)	0.257
• Strongly agree	-6.50(-9.43 to -3.56)	< 0.001
I have been able to request and take annual when I wanted (baseline = Neutral)		
• Strongly disagree	6.43(2.03 to 10.83)	0.004
• Disagree	1.13(-2.34 to 4.61)	0.523
• Agree	-2.84(-5.54 to -0.14)	0.039
• Strongly agree	-4.89(-8.06 to -1.72)	0.002
Proportion of time spent working out-of-hours (baseline = 0-25%)		
• 26-50%	5.74(3.13 to 8.35)	< 0.001

• 51-75%	10.32(7.60 to 13.03)	< 0.001
• 76-100%	14.45(10.97 to 17.92)	< 0.001

388 ¹ Each coefficient estimate is adjusted for all other covariates in the model

389 ² Null hypothesis: Adjusted Coefficient Estimate = 0 (i.e. is there statistically significant
390 evidence this category differs from the baseline category)

391 ^{ST1-ST2} *Specialist training year 1-2 (this included physicians training in Anaesthetics, Emergency
392 Medicine, Acute Medicine and General Practice)*

393 ^{SASG} *Staff grade, associate specialist and speciality grade*

394 ^{GP} *General Practitioner working within the ED*

395

396 This model was based on 3979 participants with complete data for all the
397 included covariates. Quantile regression confirmed the direction and
398 significance of the associations remained the same (Online Supplementary
399 Material 5). Each covariate was adjusted for all other statistically significant
400 associations. The results from this model indicated there were statistically
401 significant associations between gender, health conditions, type of ED (adult
402 or paediatric), clinical grade, access to annual and study leave, and time
403 spent working out-of-hours. The model suggested that males, GPs or
404 consultants, those working in paediatrics and those with no long-term health
405 condition or disability had the lowest NFR score. The greatest increase in
406 NFR score was associated with those who reported more than a 75%
407 proportion of out-of-hours work (14.45: 95% CI 10.97 to 17.92). If participants
408 strongly agreed they were able to obtain study leave upon request this
409 reduced their NFR score by 6.5 (95% CI: 3.56 to 9.43) and annual leave could
410 reduce their NFR score 4.89 (95% CI 1.72 to 8.06).

411

412 **DISCUSSION**

413 Emergency Physicians in the UK and Ireland have a higher NFR score than
414 has been reported in any previously studied population.[11,33–37] Three

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3 415 modifiable occupational factors were significantly associated with higher NFR
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5 416 scores (poor access to annual leave, and study leave, and proportion of out-of-
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7 417 hours work), and four further non-modifiable demographic factors were
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9 418 associated with a decreased NFR score. These were the senior grade of EM
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11 419 consultant, male gender, absence of long-term health condition or disability,
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13 420 and working in a paediatric only ED.
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19 422 The NFR median score of 70 found in this study compares unfavourably with
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21 423 multiple occupational groups and baseline population data from a large Dutch
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23 424 validation study, [37] where the highest frequency of responses were observed
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25 425 at the lower end of the scale. Previous measurement in shift workers (including
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27 426 hospital nurses) showed significantly lower NFR scores, [13,33] as did studies
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29 427 of heavy goods vehicle drivers and merchant seafarers, all with average NFR
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31 428 scores in the range 36-44.[35,36]. Our findings are however congruent with our
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33 429 own feasibility work completed in a single centre UK ED, reporting a median
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35 430 NFR of 81.8 in all staff groups. [21] The impact of rising patient numbers and
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37 431 overcrowding in UK and Ireland EDs is commonly reported, [39] but our findings
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39 432 are the first to illustrate the impact of high work demand on physician's need to
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41 433 recuperate from work and the modifiable factors which can mitigate this fatigue.
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49 435 The three modifiable occupational factors represent areas of autonomy
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51 436 and control, correlating well with previous work establishing these as core
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53 437 drivers to minimise physician workplace stress and ensure well-being. [2,40,41]
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55 438 Prioritising change in these domains may result in NFR score reduction and
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57 439 reduce negative effects on health and well-being, including occupational
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3 440 burnout. Whilst out-of-hours working is inherent and unavoidable in EM, the
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5 441 linear relationship we observed suggests that any reduction may result in direct
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7 442 improvements in NFR, and evidence-based strategies such as proportional
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9 443 control of out-of-hours working, annualised rota patterns and/or provision of rest
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11 444 facilities should therefore be considered urgently.[42–44]
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17 446 As NFR does not change with seniority prior to consultant level, this
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19 447 indicates that factors that could be postulated to influence work stress in
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21 448 postgraduate training such as increased responsibility, management roles and
22
23 449 experience, appear to have a limited influence on NFR. It is therefore possible
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25 450 that the reduction in NFR seen in those at consultant level supports the
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27 451 hypothesis that broader perceptions of job autonomy and control, may be
28
29 452 explicitly linked to well-being in healthcare.[2,44] This correlates with our finding
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31 453 that poor access to study and annual leave increases NFR, likely to be more
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33 454 accessible at a senior level. Further areas merit exploration including the link to
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35 455 out-of-hours working, influence of night and day shift proportions and possible
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37 456 qualitative enquiry of personal experience and clinical performance.
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45 458 The relationship observed between gender and NFR is likely to be overly
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47 459 simplistic requiring further evaluation. Presumed confounding variables
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49 460 affecting this issue (such as a primary carer role and domestic responsibilities)
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51 461 have been previously reported to be unrelated or protective against
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53 462 maladaptive fatigue and are supported with findings from this study. [45]
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3 463 Awareness of the four demographic factors identified could be important at a
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5 464 departmental planning level and increase advocacy for colleagues at greatest
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7 465 risk of impaired well-being.
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12 467 The main strength of our study is inclusion of responses from over half
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14 468 of all UK EDs, enhancing generalisability of our findings.[38] The high volume
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16 469 of responses indicate the NFR scale as an 11-item survey, is an acceptable
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18 470 measure for physicians, with over half of sites exceeding 70% response rates.
19
20 471 A key weakness is the single-point-of-time measurement, as seasonal bias may
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22 472 have affected NFR scores. Furthermore, we acknowledge the disadvantages
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24 473 of self-administered dichotomous questionnaires which may limit the richness
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26 474 of insights.[46,47] Open-ended questions may be desirable in future survey
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28 475 iterations.
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35 477 We have identified simple interventions that may reduce NFR. The
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37 478 straightforward construction and interpretation, ease of administration and
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39 479 completion confers advantages of the NFR scale over more complex well-being
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41 480 inventories allowing for quick assessment of a workforce NFR, especially in a
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43 481 busy clinical environment. Where identified to be high and interventions initiated
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45 482 such as a rota change, the NFR scale can be easily repeated to confirm or
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47 483 refute the impact, and may identify further areas resulting in continual
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49 484 improvement whilst minimising survey respondent fatigue.
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55 486 Future areas of work will include analysis of the NFR findings in
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57 487 relationship to well-being and burnout. Any future work should also include
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3 488 other ED staff groups and physician groups to gain a broader picture across
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5 489 the multi-professional team.
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10 491 In conclusion, this study provides a robust estimate of the NFR for
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12 492 Emergency Physicians in the UK and Ireland, which is higher than any
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14 493 occupation reported to date. Several potentially modifiable occupational
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16 494 characteristics were associated with higher NFR, and future work to assess the
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18 495 impact of modifying these factors will inform strategies to reduce NFR. In time
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20 496 this may lead to improved long-term physician well-being and enhanced staff
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23 497 retention.
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13 503 results.
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21 506 All authors have completed the ICMJE uniform disclosure form and declare: no
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42 515 The concept of the research was presented to over 100 members of the
43
44 516 public at a Research & Development PPI Conference on 20th September
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46 517 2018. Participants were supportive of the concept of the study, and no
47
48 518 concerns were raised. Further public and stakeholder engagement took place
49
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52 520 Annual Conference in December 2018, this influenced the outcome measures
53
54 521 and survey design including the removal of a formal burnout inventory due to
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3 522 perceptions and experience of respondent fatigue in the target participant
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5 523 group.

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10 525 **Ethics Approval:**

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12 526 This study protocol was submitted through the Integrated Research Application
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22 531 informed consent prior to beginning the survey
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28 533 **Data sharing:**

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30 534 De-identified participant level data by site will be made available on
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32 535 reasonable request through the study team (tern@rcem.ac.uk). Data will be
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34 536 available for researchers whose proposed use of the data has been approved
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36 537 by the study team.
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42 539 **Transparency statement:**

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44 540 The lead author, Dr Laura Cottey, and the co-authors affirm that this manuscript
45
46 541 is an honest, accurate, and transparent account of the study being reported;
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48 542 that no important aspects of the study have been omitted; and that any
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50 543 discrepancies from the study as planned have been explained.
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3 546 **Dissemination to participants and related patient and public**

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5 547 **communities:**

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7 548 The authors are unable to disseminate the result of the research to study
8
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16 678

679 REFERENCES

- 680
681 1 The King's Fund. The health care workforce in England: Make or
682 Break? 2018. [https://www.kingsfund.org.uk/publications/health-care-](https://www.kingsfund.org.uk/publications/health-care-workforce-england)
683 workforce-england (accessed 27 May 2020).
684 2 UK-wide review of doctors and medical students wellbeing - GMC.
685 2019. [https://www.gmc-uk.org/about/how-we-work/corporate-strategy-](https://www.gmc-uk.org/about/how-we-work/corporate-strategy-plans-and-impact/supporting-a-profession-under-pressure/uk-wide-review-of-doctors-and-medical-students-wellbeing)
686 plans-and-impact/supporting-a-profession-under-pressure/uk-wide-
687 review-of-doctors-and-medical-students-wellbeing (accessed 27 May
688 2020).
689 3 Ramirez AJ, Graham J, Richards MA, *et al*. Mental health of hospital
690 consultants: The effects of stress and satisfaction at work. *Lancet*
691 1996;347:724–8. doi:10.1016/S0140-6736(96)90077-X
692 4 Salen P, Norman K. The Impact of Fatigue on Medical Error and
693 Clinician Wellness: A Vignette-Based Discussion. In: *Vignettes in*
694 *Patient Safety - Volume 2*. 2018. doi:10.5772/intechopen.70712
695 5 Arora M, Asha S, Chinnappa J, *et al*. Review article: Burnout in
696 emergency medicine physicians. *Emerg Med Australas* 2013;25:491–5.
697 doi:10.1111/1742-6723.12135
698 6 Han S, Shanafelt TD, Sinsky CA, *et al*. Estimating the attributable cost
699 of physician burnout in the United States. *Ann Intern Med* Published
700 Online First: 2019. doi:10.7326/M18-1422
701 7 Rotenstein LS, Torre M, Ramos MA, *et al*. Prevalence of burnout
702 among physicians a systematic review. *JAMA* 2018;320:1131–50.
703 doi:10.1001/jama.2018.12777

- 1
2
3 704 8 Shanafelt TD, Hasan O, Dyrbye LN, *et al.* Changes in Burnout and
4 Satisfaction with Work-Life Balance in Physicians and the General US
5 705 Working Population between 2011 and 2014. *Mayo Clin Proc*
6 706 2015;**90**:1600–13. doi:10.1016/j.mayocp.2015.08.023
7 707
8 708 9 The Lancet T. Physician burnout: a global crisis. *Lancet* 2019;394:93.
9 709 doi:10.1016/S0140-6736(19)31573-9
10 710 10 West CP, Dyrbye LN, Erwin PJ, *et al.* Interventions to prevent and
11 711 reduce physician burnout: a systematic review and meta-analysis.
12 712 *Lancet* 2016;388:2272–81. doi:10.1016/S0140-6736(16)31279-X
13 713 11 Sluiter JK, Van Der Beek AJ, Frings-Dresen MHW. The influence of work
14 714 characteristics on the need for recovery and experienced health: A
15 715 study on coach drivers. *Ergonomics* 1999;42:573–83.
16 716 doi:10.1080/001401399185487
17 717 12 Jansen NWH, Kant I, Van Amelsvoort LGPM, *et al.* Need for recovery
18 718 from work: Evaluating short-term effects of working hours, patterns and
19 719 schedules. *Ergonomics* 2003;46:664–80
20 720 doi:10.1080/0014013031000085662
21 721 13 Sluiter JK, De Croon EM, Meijman TF, *et al.* Need for recovery from
22 722 work related fatigue and its role in the development and prediction of
23 723 subjective health complaints. *Occup Environ Med* 2003; 60(Suppl 1):
24 724 i62–i70 doi:10.1136/oem.60.suppl_1.i62
25 725 14 Sluiter JK, Frings-Dresen MH, van der Beek AJ, *et al.* The relation
26 726 between work-induced neuroendocrine reactivity and recovery,
27 727 subjective need for recovery, and health status. *J Psychosom Res*
28 728 2001;50:29–37. doi:10.1016/s0022-3999(00)00213-0
29 729 15 GMC. General Medical Council. National training surveys 2019: Initial
30 730 findings report. 2019. [https://www.gmc-uk.org/-/media/gmc-site-](https://www.gmc-uk.org/-/media/gmc-site-images/about/national-training-surveys-initial-findings-report-20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5D0B391744B0)
31 731 [images/about/national-training-surveys-initial-findings-report-](https://www.gmc-uk.org/-/media/gmc-site-images/about/national-training-surveys-initial-findings-report-20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5D0B391744B0)
32 732 [20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5](https://www.gmc-uk.org/-/media/gmc-site-images/about/national-training-surveys-initial-findings-report-20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5D0B391744B0)
33 733 [D0B391744B0](https://www.gmc-uk.org/-/media/gmc-site-images/about/national-training-surveys-initial-findings-report-20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5D0B391744B0) (accessed 27 May 2020).
34 734 16 Williamson K, Lank PM, Cheema N, *et al.* Comparing the Maslach
35 735 Burnout Inventory to other well-being instruments in emergency
36 736 medicine residents. *J Grad Med Educ*
37 737 2018;10:532–6.

- 1
2
3 738 17 Boutou A, Pitsiou G, Sourla E, Kioumis I. Burnout syndrome among
4 739 emergency medicine physicians: an update on its prevalence and risk
5 740 factors. *Eur Rev Med Pharmacol Sci* 2019 Oct;23:9058-65.
- 6
7
8 741 18 Panagioti M, Panagopoulou E, Bower P, *et al*. Controlled interventions
9 742 to reduce burnout in physicians a systematic review and meta-analysis.
10 743 *JAMA Intern Med* 2017;177:195–205.
11 744 doi:10.1001/jamainternmed.2016.7674
- 12
13
14
15 745 19 Dewa CS, Jacobs P, Thanh NX, *et al*. An estimate of the cost of burnout
16 746 on early retirement and reduction in clinical hours of practicing
17 747 physicians in Canada. *BMC Health Serv Res* 2014;14.
18 748 doi:10.1186/1472-6963-14-254
- 19
20
21
22 749 20 National Academies of Sciences E and M. *Taking Action Against*
23 750 *Clinician Burnout*. Washington, D.C. National Academies Press 2019.
24 751 doi:10.17226/25521
- 25
26
27 752 21 Graham B, Cottey L, Smith JE, *et al* Measuring ‘Need for Recovery’ as
28 753 an indicator of staff well-being in the emergency department: a survey
29 754 study. *Emerg Med J* Published Online First:
30 755 2020. doi: 10.1136/emered-2019-208797
- 31
32
33
34 756 22 Smith J, Keating L, Flowerdew L on behalf of the JLA EM PSP Steering
35 757 Group, *et al* An Emergency Medicine Research Priority Setting
36 758 Partnership to establish the top 10 research priorities in emergency
37 759 medicine. *Emerg Med J* 2017;34:454-456.
- 38
39
40
41 760 23 Eysenbach G. Improving the Quality of Web Surveys: The Checklist for
42 761 Reporting Results of Internet E-Surveys (CHERRIES). *J Med Internet*
43 762 *Res* 2004;6:e34. doi:10.2196/jmir.6.3.e34
- 44
45
46 763 24 Medicine RC of E. Essential Facts Regarding A&E Services.
47 764 2018. <https://www.rcem.ac.uk/docs/Policy/England Factsheet 2018.pdf>
48 765 (accessed 27 May 2020).
- 49
50
51 766 25 Cottey L, Vassallo J, Roberts T, Horner D, Tabner A. About TERN? -
52 767 RCEMLearning. <https://www.rcemlearning.co.uk/foamed/about-tern/>
53 768 (accessed 27 May 2020)
- 54
55
56 769 26 Lyttle MD, O’Sullivan R, Hartshorn S, *et al*. Pediatric Emergency
57 770 Research in the UK and Ireland (PERUKI): Developing a collaborative
58 771 for multicentre research. *Arch Dis Child* 2014;99:602–3.

- 1
2
3 772 doi:10.1136/archdischild-2013-304998
4
5 773 27 Van Veldhoven M, Meijman TF. *Het meten van psychosociale*
6
7 774 *arbeidsbelasting met een vragenlijst: De Vragenlijst Beleving en*
8
9 775 *Beoordeling van de Arbeid (VBBA). [Questionnaire on Perception and*
10
11 776 *Judgement of Work]*. 1994.
12
13 777 28 Van Veldhoven M, Broersen S. Measurement quality and validity of the
14
15 778 “need for recovery scale”. *Occup Environ Med* 2003;**60**:i3-i9.
16
17 779 doi:10.1136/oem.60.suppl_1.i3
18
19 780 29 Harris PA, Taylor R, Minor BL, *et al*. The REDCap consortium: Building
20
21 781 an international community of software platform partners. *J Biomed*
22
23 782 *Inform* 2019;**95**:103208. doi:10.1016/J.JBI.2019.103208
24
25 783 30 Harris PA, Taylor R, Thielke R, *et al*. Research electronic data capture
26
27 784 (REDCap)—A metadata-driven methodology and workflow process for
28
29 785 providing translational research informatics support. *J Biomed Inform*
30
31 786 2009;**42**:377–81. doi:10.1016/J.JBI.2008.08.010
32
33 787 31 StataCorp. Stata Statistical Software: Release 14. College Station, TX:
34
35 788 StataCorp LP. 2015. 2015. doi:10.2307/2234838
36
37 789 32 Van Der Starre RE, Coffeng JK, Hendriksen IJ, *et al*. Associations
38
39 790 between overweight, obesity, health measures and need for recovery in
40
41 791 office employees: A cross-sectional analysis. *BMC Public Health*
42
43 792 Published Online First: 2013. doi:10.1186/1471-2458-13-1207
44
45 793 33 Moriguchi CS, Trevizani T, De Fátima Carreira Moreira R, *et al*. Need
46
47 794 for recovery assessment among nursing professionals and call center
48
49 795 operators. In: *Work*. 2012. 4838–42. doi:10.3233/WOR-2012-0773-4838
50
51 796 34 Samadi H, Kalantari R, Mostafavi F, *et al*. Using the Need for Recovery
52
53 797 Scale to Assess Workload in Mine Workers and Its Relationship With
54
55 798 Demographics. *J Ergon* 2017;**4**:1–7. doi:10.21859/joe-04041
56
57 799 35 Bridger RS, Brasher K, Dew A. Work demands and need for recovery
58
59 800 from work in ageing seafarers. *Ergonomics* 2010;**53**:1006–15.
60
801 doi:10.1080/00140139.2010.493958
802 36 De Croon EM, Sluiter JK, Frings-Dresen MHW. Need for recovery after
803
804 work predicts sickness absence: A 2-year prospective cohort study in
805
3999(02)00630-X

- 1
2
3 806 37 Jansen NWH, Kant IJ, van den Brandt PA. Need for recovery in the
4
5 807 working population: description and associations with fatigue and
6
7 808 psychological distress. *Int J Behav Med* 2002;9:322–40.
- 8
9 809 38 Hassan T, Walker B, Harrison M, *et al.*
10
11 810 [www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-](http://www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-October_2013.pdf)
12
13 811 [October_2013.pdf](http://www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-October_2013.pdf). 2013.[www.rcem.ac.uk/docs/Policy/CEM7461-](http://www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-October_2013.pdf)
14
15 812 [Stretched-to-the-limit-October_2013.pdf](http://www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-October_2013.pdf) (accessed 27 Ma7 2020).
- 16
17 813 39 The Royal College of Emergency Medicine. Improving safety in the
18
19 814 Emergency Department this winter: a guide for health service leaders
20
21 815 and boards. 2018.
22
23 816 [https://www.rcem.ac.uk/RCEM/Quality_Policy/Policy/Winter_Planning/R](https://www.rcem.ac.uk/RCEM/Quality_Policy/Policy/Winter_Planning/RCEM/Quality-Policy/Policy/Winter_Planning.aspx?hkey=e37845aa-c9a5-4b01-aa72-48137cc59aa1)
24
25 817 [CEM/Quality-Policy/Policy/Winter_Planning.aspx?hkey=e37845aa-](https://www.rcem.ac.uk/RCEM/Quality_Policy/Policy/Winter_Planning/RCEM/Quality-Policy/Policy/Winter_Planning.aspx?hkey=e37845aa-c9a5-4b01-aa72-48137cc59aa1)
26
27 818 [c9a5-4b01-aa72-48137cc59aa1](https://www.rcem.ac.uk/RCEM/Quality_Policy/Policy/Winter_Planning/RCEM/Quality-Policy/Policy/Winter_Planning.aspx?hkey=e37845aa-c9a5-4b01-aa72-48137cc59aa1) (accessed 23 July 2020)
- 28
29 819 40 Hall LH, Johnson J, Heyhoe J, *et al.* Strategies to improve general
30
31 820 practitioner well-being: Findings from a focus group study. *Fam Pract*
32
33 821 Published Online First: 2018. doi:10.1093/fampra/cmz130
- 34
35 822 41 Galletta M, Portoghese I, Fabbri D, *et al.* Empowering workplace and
36
37 823 wellbeing among healthcare professionals: The buffering role of job
38
39 824 control. *Acta Biomed* 2016;87:61–9.
- 40
41 825 42 NHS Improvement. Annualised hours rotas for emergency department
42
43 826 doctors. 2019.
44
45 827 [https://improvement.nhs.uk/documents/5919/Brighton__Sussex_-](https://improvement.nhs.uk/documents/5919/Brighton__Sussex_-_annualised_hours_rotas.pdf)
46
47 828 [_annualised_hours_rotas.pdf](https://improvement.nhs.uk/documents/5919/Brighton__Sussex_-_annualised_hours_rotas.pdf) (accessed 27 May 2020).
- 48
49 829 43 Rimmer A. Government commits £10m to doctors' rest facilities. *BMJ*
50
51 830 2233 doi: <http://doi.org/10.1136/bmj.l2233>
- 52
53 831 44 Smith E, Dasan S. A system under pressure. *Br J Hosp Med*
54
55 832 2018;79:495–9. doi:10.12968/hmed.2018.79.9.495
- 56
57 833 45 Winwood PC, Winefield AH, Lushington K. Work-related fatigue and
58
59 834 recovery: The contribution of age, domestic responsibilities and
60
835 shiftwork. *J Adv Nurs* 2006;56:438–49. doi:10.1111/j.1365-
836
2648.2006.04011.x
- 837 46 Dykema J, Jones NR, Piché T, *et al.* Surveying Clinicians by Web:
838
839 Current Issues in Design and Administration. *Eval Heal Prof* Published
Online First: 2013;36:352-81. doi:10.1177/0163278713496630

840 47 Klabunde CN, Willis GB, McLeod CC, *et al.* Improving the Quality of
 841 Surveys of Physicians and Medical Groups: A Research Agenda. *Eval*
 842 *Heal Prof* 2012;35:477-506 doi:10.1177/0163278712458283

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846 Research Checklist: The Checklist for Reporting Results of Internet E-Surveys
 847 (CHERRIES)

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CHERRIES CHECKLIST ADAPTED FROM:			
Eysenbach, Gunther. "Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES)." <i>Journal of medical Internet research</i> vol. 6,3 e34. 29 Sep. 2004, doi:10.2196/jmir.6.3.e34			
Item Category	Checklist Item	Explanation	Checklist Response
Design	Describe survey design	Describe target population, sample frame. Is the sample a convenience sample? (In "open" surveys this is most likely.)	Outlined in 'Methods'
IRB (Institutional Review Board) approval and informed consent process	IRB approval	Mention whether the study has been approved by an IRB.	Outlined in 'Ethics Approval'
	Informed consent	Describe the informed consent process. Where were the participants told the length of time of the survey, which data were stored and where and for how long, who the investigator was, and the purpose of the study?	Outlined in Survey Distribution, monitoring and recruitment
	Data protection	If any personal information was collected or stored, describe what mechanisms were used to protect unauthorized access.	Outlined in Survey Distribution, monitoring and recruitment
Development and pre-testing	Development and testing	State how the survey was developed, including whether the usability and technical functionality of the electronic questionnaire had been tested before fielding the questionnaire.	Outlined in 'Survey Development'
Recruitment process and description of the sample having access to the questionnaire	Open survey versus closed survey	An "open survey" is a survey open for each visitor of a site, while a closed survey is only open to a sample which the investigator knows (password-protected survey).	Outlined in Survey Distribution, monitoring and recruitment
	Contact mode	Indicate whether or not the initial contact with the potential participants was made on the Internet. (Investigators may also send out	Outlined in 'Survey Distribution, monitoring and recruitment'

		questionnaires by mail and allow for Web-based data entry.)	
	Advertising the survey	How/where was the survey announced or advertised? Some examples are offline media (newspapers), or online (mailing lists – If yes, which ones?) or banner ads (Where were these banner ads posted and what did they look like?). It is important to know the wording of the announcement as it will heavily influence who chooses to participate. Ideally the survey announcement should be published as an appendix.	Outlined in 'Survey Distribution, monitoring and recruitment'
Survey administration	Web/E-mail	State the type of e-survey (eg, one posted on a Web site, or one sent out through e-mail). If it is an e-mail survey, were the responses entered manually into a database, or was there an automatic method for capturing responses?	Outlined in 'Survey Distribution, monitoring and recruitment'
	Context	Describe the Web site (for mailing list/newsgroup) in which the survey was posted. What is the Web site about, who is visiting it, what are visitors normally looking for? Discuss to what degree the content of the Web site could pre-select the sample or influence the results. For example, a survey about vaccination on an anti-immunization Web site will have different results from a Web survey conducted on a government Web site	Outlined in 'Design'
	Mandatory/voluntary	Was it a mandatory survey to be filled in by every visitor who wanted to enter the Web site, or was it a voluntary survey?	Outlined in 'Survey Distribution, monitoring and recruitment'
	Incentives	Were any incentives offered (eg, monetary, prizes, or non-monetary incentives such as an offer to provide the survey results)?	No
	Time/Date	In what timeframe were the data collected?	Outlined in 'Sites and settings'
	Randomization of items or questionnaires	To prevent biases items can be randomized or alternated.	Not done
	Adaptive questioning	Use adaptive questioning (certain items, or only conditionally displayed based on responses to other items) to reduce number and complexity of the questions	Outlined in Survey Distribution, monitoring and recruitment
	Number of Items	What was the number of questionnaire items per page? The number of items is an important factor for the completion rate.	Outlined in 'Design'

	Number of screens (pages)	Over how many pages was the questionnaire distributed? The number of items is an important factor for the completion rate.	Outlined in 'Design'
	Completeness check	It is technically possible to do consistency or completeness checks before the questionnaire is submitted. Was this done, and if "yes", how (usually JavaScript)? An alternative is to check for completeness after the questionnaire has been submitted (and highlight mandatory items). If this has been done, it should be reported. All items should provide a non-response option such as "not applicable" or "rather not say", and selection of one response option should be enforced.	Not done
	Review step	State whether respondents were able to review and change their answers (eg, through a Back button or a Review step which displays a summary of the responses and asks the respondents if they are correct).	Outlined in Survey Distribution, monitoring and recruitment
Response rates			
	Unique site visitor	If you provide view rates or participation rates, you need to define how you determined a unique visitor. There are different techniques available, based on IP addresses or cookies or both.	Outlined in 'Results'
	View rate (Ratio of unique survey visitors/unique site visitors)	Requires counting unique visitors to the first page of the survey, divided by the number of unique site visitors (not page views!). It is not unusual to have view rates of less than 0.1 % if the survey is voluntary	Survey site contains first page of survey therefore N/A
	Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)	Count the unique number of people who filled in the first survey page (or agreed to participate, for example by checking a checkbox), divided by visitors who visit the first page of the survey (or the informed consents page, if present). This can also be called "recruitment" rate.	Outlined in 'Results'
	Completion rate (Ratio of users who finished the survey/users who agreed to participate)	The number of people submitting the last questionnaire page, divided by the number of people who agreed to participate (or submitted the first survey page). This is only relevant if there is a separate "informed consent" page or if the survey goes over several pages. This is a measure for attrition. Note that "completion" can involve leaving questionnaire items blank. This is not a measure for how completely questionnaires were filled in. (If you need a measure for this, use the word "completeness rate".)	Outlined in 'Results'
Preventing multiple	Cookies used	Indicate whether cookies were used to assign a unique user identifier to each	Not used

<p>entries from the same individual</p>		<p>client computer. If so, mention the page on which the cookie was set and read, and how long the cookie was valid. Were duplicate entries avoided by preventing users access to the survey twice; or were duplicate database entries having the same user ID eliminated before analysis? In the latter case, which entries were kept for analysis (eg, the first entry or the most recent)?</p>	
	<p>IP check</p>	<p>Indicate whether the IP address of the client computer was used to identify potential duplicate entries from the same user. If so, mention the period of time for which no two entries from the same IP address were allowed (eg, 24 hours). Were duplicate entries avoided by preventing users with the same IP address access to the survey twice; or were duplicate database entries having the same IP address within a given period of time eliminated before analysis? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?</p>	<p>Not used due to survey being completed on multi-user/single log-in computers</p>
	<p>Log file analysis</p>	<p>Indicate whether other techniques to analyze the log file for identification of multiple entries were used. If so, please describe.</p>	<p>Not done</p>
	<p>Registration</p>	<p>In “closed” (non-open) surveys, users need to login first and it is easier to prevent duplicate entries from the same user. Describe how this was done. For example, was the survey never displayed a second time once the user had filled it in, or was the username stored together with the survey results and later eliminated? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?</p>	<p>N/A</p>
<p>Analysis</p>	<p>Handling of incomplete questionnaires</p>	<p>Were only completed questionnaires analyzed? Were questionnaires which terminated early (where, for example, users did not go through all questionnaire pages) also analyzed?</p>	<p>Outlined in ‘Data Analysis’</p>
	<p>Questionnaires submitted with an atypical timestamp</p>	<p>Some investigators may measure the time people needed to fill in a questionnaire and exclude questionnaires that were submitted too soon. Specify the timeframe that was used as a cut-off point, and describe how this point was determined</p>	<p>N/A</p>
	<p>Statistical correction</p>	<p>Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for the non-</p>	<p>Outlined in ‘Data Analysis’</p>

		representative sample; if so, please describe the methods.	
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Figure Legend

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Figure 1

861 Box plots of Need for Recovery (NFR) score by participant demographic
862 characteristics, excluding any participants who does not respond to the
863 question (i.e. missing).

864 Plot a) age group in years; b) gender; c) clinical grade; d) any long-term
865 health condition or disability.

866

867 ST1-ST2=Specialist Training year 1-2 (this included physicians training in
868 Anaesthetics, Emergency Medicine, Acute Medicine and General Practice)

869 SASG=Staff grade, associate specialist and speciality grade

870 GP=General Practitioner working within the emergency department (ED)

871

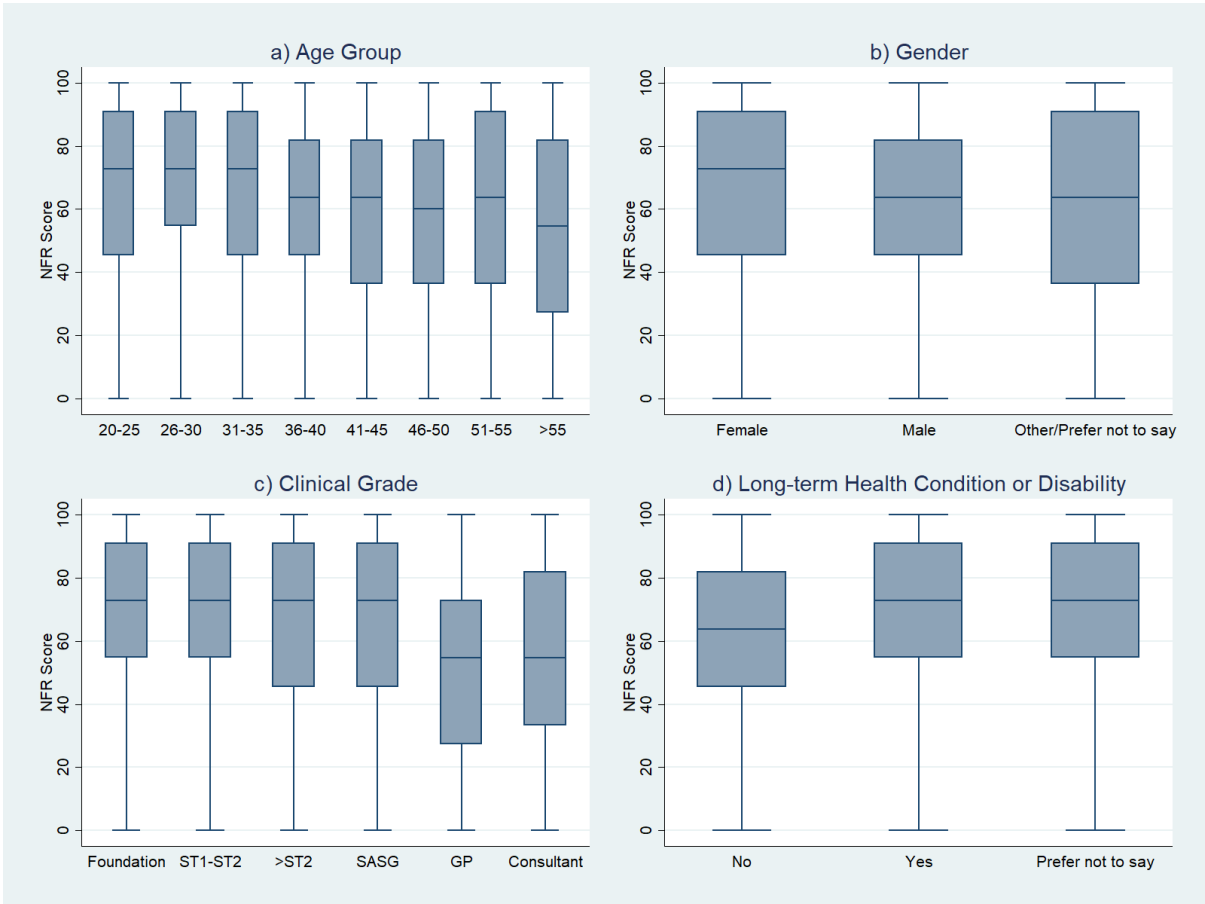
Figure 2

873 Box plot of Need for Recovery (NFR) score by participant's occupational
874 characteristics, excluding any participants who does not respond to the
875 question (i.e. missing).

876 Plot a) ability to obtain study leave when requested; b) ability to obtain annual
877 leave when requested; c) proportion of time working out-of-hours; d) working
878 in paediatrics emergency departments (ED) only.

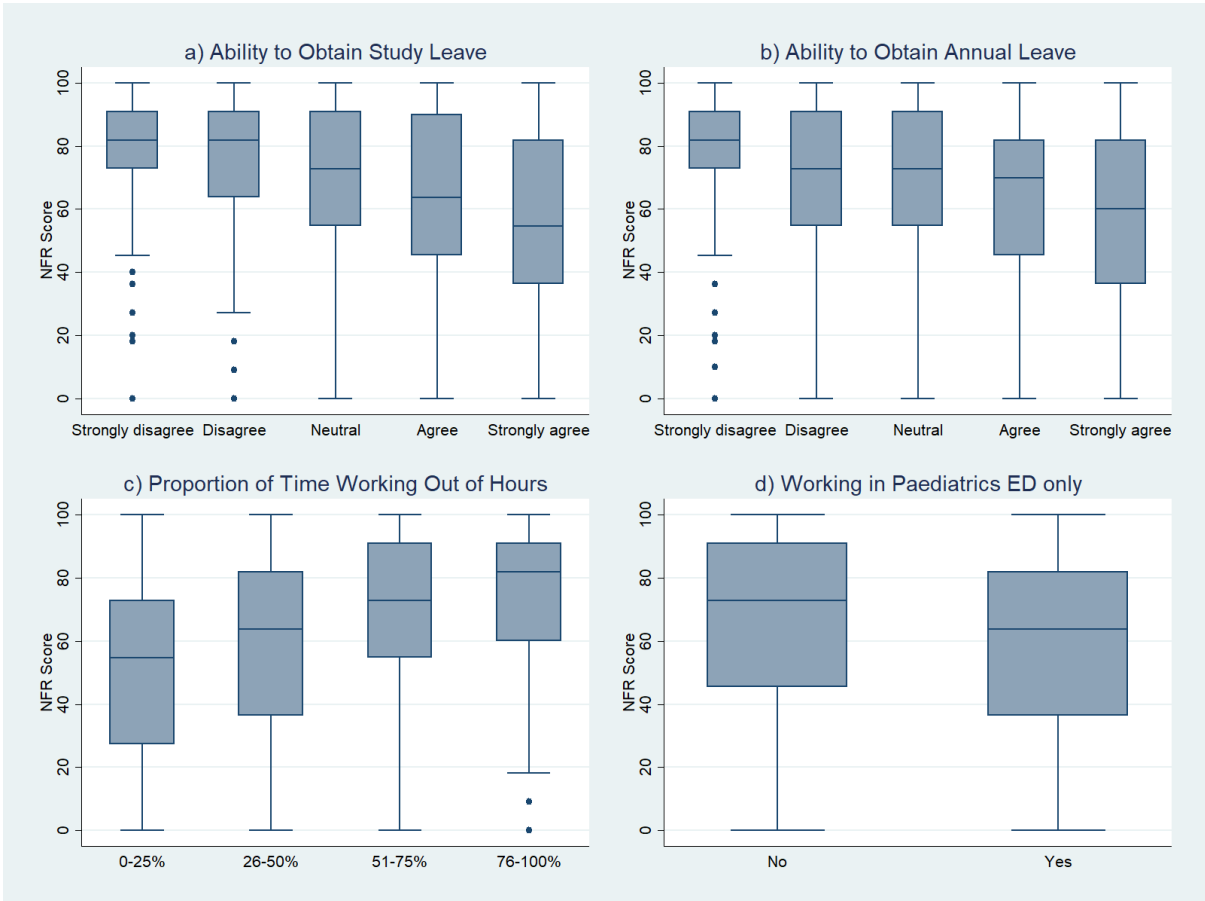
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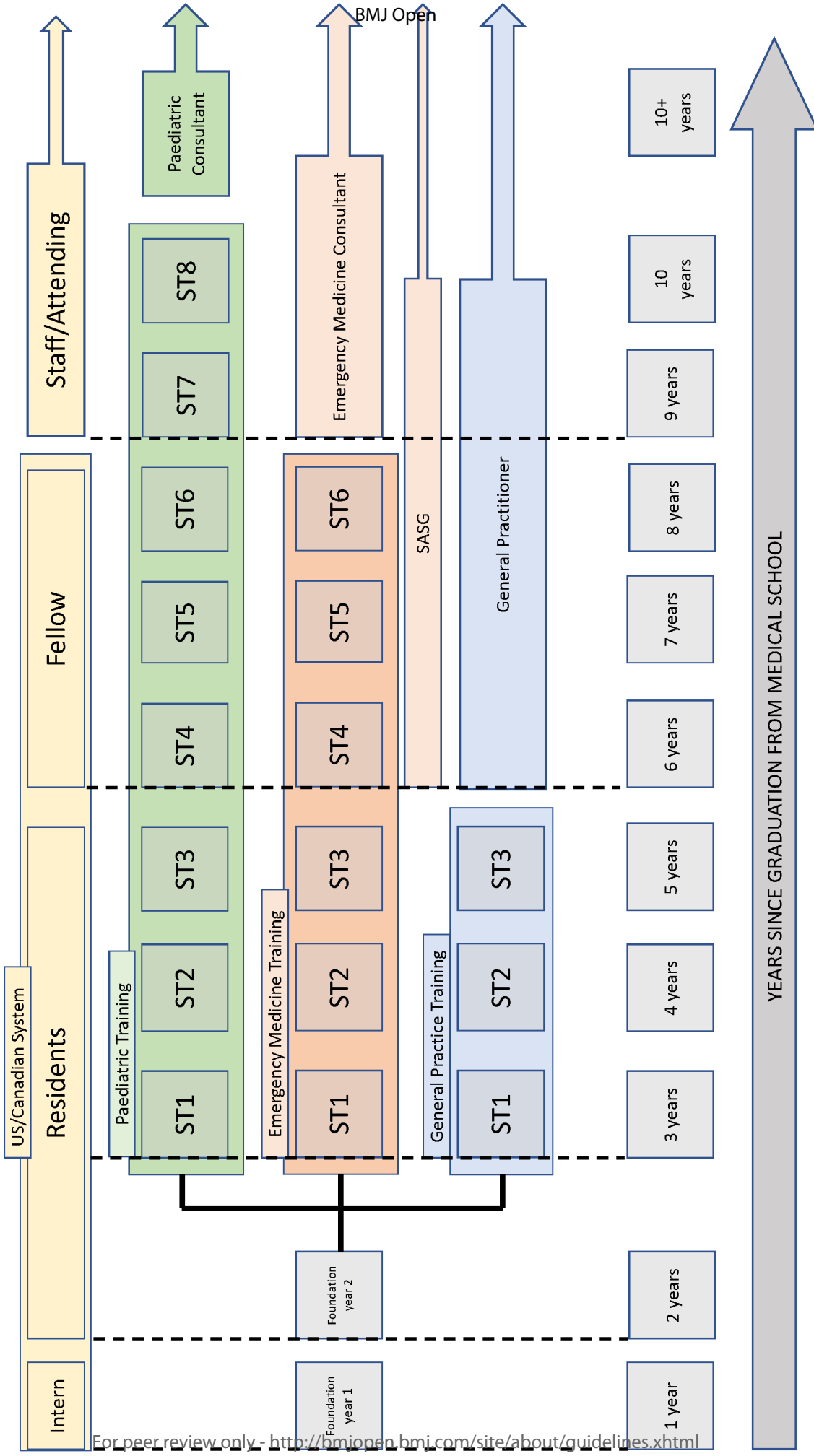
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Emergency Department Need For Recovery Survey

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Do you want to read the patient participation leaflet, GDPR and consent information now?

- Yes
- No

For peer review only

1 Participant Information Sheet

2
3 Welcome to the 2019 TERN Need for Recovery Survey.

4
5 This is an electronic participant information sheet.
6 Please take a minute or two to read this information
7 before proceeding with the survey.

8
9 What is need for recovery?

10 Need for recovery is the time taken to physically and
11 psychologically recover from work. Increased need
12 for recovery is linked to fatigue and a range of
13 physical and psychological health outcomes including
14 burnout.

15 Why have I been asked to take part?

16 You are either:

- 17 • A doctor working in an emergency department which
18 has been nominated to participate in this survey.

19 What is the purpose of the study?

20 This survey is being conducted as part of a national
21 survey by the Trainee Emergency Research Network
22 (TERN). The project is being led by Dr Laura Cottey
23 (Chief Investigator) and Dr Blair Graham, with
24 oversight from the TERN executive committee. We hope
25 that the results from this survey will provide a
26 baseline assessment of trainee need for recovery,
27 and demonstrate risk factors that may indicate an
28 increased need for recovery. It is hoped that this
29 survey will provide insight into the phenomenon of
30 need for recovery amongst Emergency Department
31 doctors, show where differences exist, and how need
32 for recovery may be reduced in the future.
33 Ultimately it is hoped that this survey may lead to
34 initiatives to improve the working lives of doctors
35 in the emergency department.

36 What will happen if I take part?

37 You will asked to take part in this electronic
38 questionnaire. You should allocate about 5 minutes
39 to complete the questionnaire, although you can save
40 and return to completing the questionnaire at a
41 later time.

42
43 Do I have to take part?

44 In order that these results can inform future
45 initiatives to improve working lives of emergency
46 doctors, we do require a robust response rate.
47 However, you are under no obligation to take part
48 and may withdraw at any point without the need to
49 give a reason.

50 Should you have uncertainties of queries about this
51 survey, please do not hesitate to contact the study
52 team.

53
54 What will happen to my data if I withdraw my
55 involvement?

56 If you choose to withdraw your involvement in the
57 study, any results that you have submitted will be
58 kept for analysis. However, you will not be required
59 to input further into the study.

60
If you would like to be formally withdrawn from the
study at any point, please contact the study team
(TERN@rcem.ac.uk). You do not have to give a reason.

For peer review only - <http://bmjopen.bmj.com/site/about/guidelines.xhtml>

Are there any potential risks or benefits of taking

BMJ 2020;13:e003363

This survey will provide valuable insight into the wellbeing of emergency department doctors nationally. We appreciate issues such as wellbeing and burnout are sensitive. We have included some information about sources that you might wish to contact for support both as part of this introduction, and at the end of the survey.

Who is involved in this project?

The project is being led by Dr Laura Cottey (Chief Investigator) and Dr Blair Graham, with oversight from the TERN executive committee which is led by Dr Tom Roberts. The study is indirectly supported by the Royal College of Emergency Medicine, but TERN is independent from the college.

What if something goes wrong?

It is very unlikely that anything will go wrong. If you feel it does, please contact the study team directly.

How will you protect my data and confidentiality?

The University Hospitals Plymouth NHS Trust is the sponsor for this study. The sponsor will be using information in order to undertake the study and will be responsible for looking after your information and using it properly. The data collected will be kept for 10 years after the study has finished.

Your rights to access, change or move your information are limited, as we need to manage your information in specific ways in order for the research to be reliable and accurate. If you withdraw from the study, we will keep the information about you that we have already obtained. To safeguard your rights, we will use the minimum personally identifiable information possible.

This study is also compliant with the General Data Protection Regulations (GDPR). For more information about GDPR click here.

How may I contact the study team in the future?

You can contact the study team by emailing Dr Laura Cottey at laura.cottey@nhs.net

What to do if you need support about wellbeing

The following organisations can help provide advice and support with regards to your wellbeing.

-Your occupational health department (contact details available via your employer)

-Your general practitioner

-BMA Counselling Service (24 Hours). Telephone 0330 123 1245. (Note that you do not have to be a member of the BMA to access this service)

-The Samaritans (24 Hours). Telephone 116 123.

You can also access further information and signposting online via the Doctors Support Network <https://www.dsn.org.uk/>

Feel free to leave any comments.

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Consent Question 1: Yes
I have read and understood the participant No
information

Consent Question 2: Yes
I understand the information about confidentiality No
and GDPR

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Demographic Characteristics

What is your current job role?

- ST1
 ST2
 ST3
 ST4
 ST5
 ST6
 ST7
 ST8
 F1
 F2
 Clinical Fellow (F2-ST3 Level)
 Clinical Fellow (>=ST4 Level)
 Consultant
 Associate Specialist
 Staff Grade
 CESR Doctor
 GP Trainee
 GP
 Other (please specify)

What is your job role?

Which country do you work in?

- Scotland
 Northern Ireland
 Wales
 England
 Republic of Ireland

Which hospital do you currently work in?

- Aberdeen
 Victoria Hospital, Kirkcaldy
 Forth Valley Royal Hospital
 Monklands Hospital
 Royal Hospital for Children, Glasgow
 Royal Infirmary of Edinburgh
 St John's, Livingston
 NHS Greater Glasgow and Clyde - Queen Elizabeth
 NHS Greater Glasgow and Clyde - Glasgow Royal Infirmary
 Crosshouse, Ayrshire
 Royal Alexandria, Paisley
 Ayr
 Royal Hospital for Sick Children, Edinburgh
 Other

Which hospital do you currently work in?

- Craigavon Area Hospital, Northern Ireland
 Royal Victoria Hospital, Belfast
 Ulster Hospital, Belfast
 Other

1 Which hospital do you currently work in?
2

- 3 Cardiff, University Hospital of Wales
4 Ysbyty Gwynedd, Bangor
5 Morriston Hospital, Swansea
6 Wrexham, North Wales
7 Other
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1 Which hospital do you currently work in (the list is mostly alphabetically but if you cannot find your hospital please
2 check the bottom)?
3

- 4 Addenbrooke's Hospital
5 Aintree
6 Airedale General Hospital
7 Basingstoke Emergency Department
8 Bedford hospital emergency department
9 Birmingham
10 Bolton
11 Bradford Royal Infirmary
12 Brighton (Royal Sussex County Hospital)
13 Bristol Childrens Hospital
14 Bristol Royal Infirmary (Adults)
15 Cambridge University Hospitals
16 Chelsea & Westminster Hospital
17 Croydon University Hospital
18 Doncaster Royal Infirmary
19 William Harvey ED
20 East Surrey Hospital ED
21 Epsom and St Helier NHS Trust
22 Gloucestershire Hospitals NHS Foundation Trust
23 Great Western Hospital Swindon
24 Hampshire Hospitals NHS Trust (Basingstoke and Winchester)
25 Harrogate Emergency Department
26 Homerton Emergency Department
27 Ipswich Hospital
28 James Cook University Hospital Middlesbrough
29 James Paget University Hospital
30 Leeds teaching hospitals
31 Leicester Royal Infirmary
32 Leighton (Crewe)
33 Lewisham university hospital
34 Lister Hospital
35 QEH, London
36 Manchester Royal Infirmary
37 Milton Keynes University
38 Musgrove Park Hospital, Taunton
39 Northern general hospital
40 Northumbria Specialist Emergency Care Hospital
41 Northwick Park Hospital
42 Oxford University Hospital NHS Foundation Trust/
43 Portsmouth - Queen Alexandra Hospital,
44 Plymouth- Derriford
45 Reading
46 Royal Berkshire Hospital
47 Royal Blackburn Hospital
48 Royal Cornwall Hospital, Truro
49 Royal Devon & Exeter Hospital
50 Royal Liverpool University Hospital
51 The Royal London Hospital (Paeds)
52 The Royal London Hospital (Adults)
53 Royal Manchester Children's Hospital
54 Royal Oldham Hospital
55 Royal Preston hospital
56 Royal Shrewsbury Hospital
57 Royal Stoke
58 Royal Surrey County Hospital
59 Royal United Hospital Bath
60 Royal Victoria, Newcastle
 Salford Royal Hospital, Manchester
 Sheffield Childrens Hospital ED
 Medway Foundation NHS Trust
 Mid Cheshire Hospitals NHS Foundation Trust
 University Hospital Southampton
 St Helens and Knowsley
 Southmead Hospital
 Surrey and Sussex Healthcare NHS Trust
 St George's Hospital Tooting

For peer review only

- 1 St Marys Hospital, London
2 St Richards hospital
3 St Thomas' Hospital
4 Torbay
5 Tunbridge Wells Hospital
6 Southport District General Hospital
7 University College Hospital, London
8 University Hospital Coventry and Warwickshire
9 Warrington
10 University Hospitals of Derby and Burton NHS Foundation Trust
11 Watford General hospital
12 West Middlesex University Hospital
13 West Suffolk Hospital
14 Frimley Park Hospital
15 Wexham Park Hospital, Frimley Health NHS
16 Whiston Hospital
17 Wythenshawe Hospital
18 Yeovil District Hospital
19 York District hospital
20 York Hospital Emergency Departments
21 Whiston Hospital
22 William Harvey Hospital
23 Worthing Hospital
24 University hospital of Hull
25 North Middlesex
26 Sandwell and West Birmingham
27 Stoke Mandeville
28 Colchester
29 Alder Hey Children's Hospital
30 Queen's Hospital, Romford
31 Birmingham Children's Hospital
32 Sunderland Royal Hospital
33 Countess of Chester NHS foundation trust
34 University hospital of North Durham
35 Evelina Children's Hospital
36 King's College, London
37 Barnstaple
38 Nottingham University Hospital
39 Royal Alexandra Children's Hospital
40 Royal Wolverhampton
41 Salisbury NHS Trust
42 Western Sussex NHS Trust
43 Other
44 Alder Hey Childrens Hospital
45 Birmingham Women's and Childrens Hospital
46 Countess of Chester
47 Evelina, Guys and St Thomas's
48 Kings College Hospital
49 Royal Alexandra Children's Hospital, Brighton and Sussex
50 New Cross Hospital
51 Salisbury
52 Barking, Havering & Redbridge - Queen's
53 Barking, Havering & Redbridge - King George
54 South Tyneside and Sunderland NHS Trust
55 County Durham and Darlington
56 North Manchester General Hospital

1 Which hospital do you currently work in?
2

- 3 University Hospital Galway
- 4 Mater Misericordiae University Hospital, Dublin,
- 5 Sligo University Hospital
- 6 Limerick regional Hospital
- 7 Other
- 8 Children's Health Ireland at Crumlin
- 9 Children's Health Ireland at Temple Street
- 10 Children's Health Ireland at Tallaght
- 11 Bon Secours Hospital
- 12 Cork University Hospital

13
14 Please state the name of your hospital.
15
16
17 _____
18 _____

19 What type of patients do you see in your Emergency Department?
20

- 21 Adults only
- 22 Paediatrics only
- 23 Mixture of Adults and Paediatrics

24
25 How old are you?
26

- 27 20-25
- 28 26-30
- 29 31-35
- 30 36-40
- 31 41-45
- 32 46-50
- 33 51-55
- 34 56-60
- 35 61- 65
- 36 66-70
- 37 >70

38
39 What is your gender?
40

- 41 Female
- 42 Male
- 43 Other
- 44 Prefer not to say

Please fill out the following "Need for Recovery Score". Please base this on the LAST MONTH of work (excluding leave).

	yes	no
I find it difficult to relax at the end of the working day?	<input type="radio"/>	<input type="radio"/>
By the end of the working day I feel really worn-out	<input type="radio"/>	<input type="radio"/>
Because of my job, at the end of the working day I feel rather exhausted	<input type="radio"/>	<input type="radio"/>
After my breaks, I feel fresh to continue my work	<input type="radio"/>	<input type="radio"/>
Generally speaking, I only start to feel relaxed on my second non-working day off	<input type="radio"/>	<input type="radio"/>
I find it difficult to concentrate in my free time after work	<input type="radio"/>	<input type="radio"/>
I find it hard to show interest in other people when I have just come home from work	<input type="radio"/>	<input type="radio"/>
In general, it takes me over an hour to feel fully recuperated after work	<input type="radio"/>	<input type="radio"/>
When I get home, I need to be left in peace for a while	<input type="radio"/>	<input type="radio"/>
Often, after a day's work I feel so tired that I cannot get involved in other activities	<input type="radio"/>	<input type="radio"/>
A feeling of tiredness prevents me from doing my work as well as I normally would during the last part of the working day	<input type="radio"/>	<input type="radio"/>

How long have you worked in your current Emergency Department?

- 1 month or less
- 1-2 months
- 2-3 months
- 3-4 months
- 4-5 months
- 5-6 months
- 6 months - 1 year
- 1-2 years
- 2-3 years
- 3-5 years
- 5 -10 years
- 10 -15 years
- 15-20 years
- > 20 years

1 How long have you worked in Emergency Medicine in total in your career?
2

- 3 1 year or less
4 1 year or more
5

6 How many months have you worked in Emergency Medicine in total?
7

8 _____
9
10

11 How many years have you worked in Emergency Medicine in total?
12

13 _____
14
15

16 What is your most frequent method of transport for your commute to work?
17

- 18 Car
19 Motorbike
20 Bus
21 Train
22 Underground
23 Walk
24 Run
25 Cycle
26 I live on-site
27 Other
28

29 You have selected other, how do you commute?
30

31 _____
32
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60

How long does your commute take in minutes (one way)?

	1-10 mins	11-20 mins	21-30 mins	31-40 mins	41-50 mins	51-60 mins	61-70 mins	71-80 mins	81-90 mins	>90 mins
On an average day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On a good day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On a bad day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What type of contract do you work?

- Full time
 90%, less than full time
 80%, less than full time
 70%, less than full time
 60%, less than full time
 50%, less than full time
 less than 50%, less than full time

Do you have dedicated contracted time away from Adult Emergency Medicine (e.g. subspecialty or GP) or work in Paediatric Emergency Medicine?

- Yes
 No

Please select all that are applicable to your current contracted time.

- ICM
 PEM
 PHEM
 Academic
 Teaching
 Leadership/Management
 Paediatrics
 GP
 Other

What is your "other" contracted time?

What percentage of your contract is spent in ICM rather than EM?

- 10%
 20%
 25%
 30%
 40%
 50%
 60%
 70%
 75%
 80%
 90%
 100%

1 What percentage of your contract is spent in PEM rather than Adult EM?
2

- 3 10%
- 4 20%
- 5 25%
- 6 30%
- 7 40%
- 8 50%
- 9 60%
- 10 70%
- 11 75%
- 12 80%
- 13 90%
- 14 100%

16 What percentage of your contract is spent in PHEM rather than Adult EM?
17

- 18 10%
- 19 20%
- 20 25%
- 21 30%
- 22 40%
- 23 50%
- 24 60%
- 25 70%
- 26 75%
- 27 80%
- 28 90%
- 29 100%

31 What percentage of your contract is spent Academic rather than Adult EM?
32

- 33 10%
- 34 20%
- 35 25%
- 36 30%
- 37 40%
- 38 50%
- 39 60%
- 40 70%
- 41 75%
- 42 80%
- 43 90%
- 44 100%

45 What percentage of your contract is spent Teaching rather than Adult EM?
46

- 47 10%
- 48 20%
- 49 25%
- 50 30%
- 51 40%
- 52 50%
- 53 60%
- 54 70%
- 55 75%
- 56 80%
- 57 90%
- 58 100%
- 59
- 60

1 What percentage of your contract is spent management/leadership rather than Adult EM?
2

- 3 10%
4 20%
5 25%
6 30%
7 40%
8 50%
9 60%
10 70%
11 75%
12 80%
13 90%
14 100%

16 What percentage of your contract is spent doing paediatrics rather than EM?
17

- 18 10%
19 20%
20 25%
21 30%
22 40%
23 50%
24 60%
25 70%
26 75%
27 80%
28 90%
29 100%

31 What percentage of your contract is spent doing GP rather than Adult EM?
32

- 33 10%
34 20%
35 25%
36 30%
37 40%
38 50%
39 60%
40 70%
41 75%
42 80%
43 90%
44 100%

45 What percentage of your contract is spent doing "other" activities rather than Adult EM?
46

- 47 10%
48 20%
49 25%
50 30%
51 40%
52 50%
53 60%
54 70%
55 75%
56 80%
57 90%
58 100%
59
60

1 What is the maximum number of TOTAL clinical shifts you work in a week?
2

- 3 1 shift
- 4 2 shifts
- 5 3 shifts
- 6 4 shifts
- 7 5 shifts
- 8 6 shifts
- 9 7 shifts

11 What is the maximum number of CONSECUTIVE clinical shifts you would be scheduled to work?
12

- 13 1 shift
- 14 2 shifts
- 15 3 shifts
- 16 4 shifts
- 17 5 shifts
- 18 6 shifts
- 19 7 shifts
- 20 > 7 shifts

22 What is the maximum number of consecutive NIGHT shifts you would be scheduled to work in a row?
23

- 24 0 shifts
- 25 1 shift
- 26 2 shifts
- 27 3 shifts
- 28 4 shifts
- 29 5 shifts
- 30 6 shifts
- 31 7 shifts

33 What is the maximum number of consecutive DAY shifts you would be scheduled to work in a row?
34

- 35 0 shifts
- 36 1 shift
- 37 2 shifts
- 38 3 shifts
- 39 4 shifts
- 40 5 shifts
- 41 6 shifts
- 42 7 shifts

44 What is the maximum number of consecutive TWILIGHT shifts you would be scheduled to work in a row?
45

- 46 0 shifts
- 47 1 shift
- 48 2 shifts
- 49 3 shifts
- 50 4 shifts
- 51 5 shifts
- 52 6 shifts
- 53 7 shifts

1 What is your scheduled weekend work frequency?
2

- 3 1 in 2
4 1 in 3
5 1 in 4
6 1 in 5
7 1 in 6
8 Less frequent than 1 in 6
9 I don't work weekends
-

11 Over the past month how many contracted non-clinical shifts have you had? E.g. SPA, teaching, clinical governance.
12

- 13 0 shifts
14 Between 0-1 shifts
15 1 shift
16 2 shifts
17 3 shifts
18 4 shifts
19 5 shifts
20 6 shifts
21 7 shifts
22 8 shifts
23 9 shifts
24 10 shifts
25 11-15 shifts
26 >15 shifts
-

28 In the past month how many locum shifts have you
29 worked? _____

31 Over the past month, roughly how often have you left more than 15 minutes late following a clinical shift?
32

- 33 Rarely
34 A few times a month
35 Once a week
36 A few times a week
37 Everyday
-

39 Over the past month, how often have you taken your full entitlement of breaks during a clinical shift?
40

- 41 Rarely
42 A few times a month
43 Once a week
44 A few times a week
45 Everyday
-

47 What proportion would you say you spend working 'out of hours' (evenings, nights or weekends)?
48

- 49 < 25%
50 26-50%
51 51-75%
52 76-100%
-

54 What proportion of your locum shifts would you say you spend working 'out of hours' (evenings, nights or weekends)?
55

- 56 < 25%
57 26-50%
58 51-75%
59 76-100%
-
- 60

1 I have been able to request and take the annual leave I wanted?
2

- 3 Strongly disagree
4 Disagree
5 Neutral
6 Agree
7 Strongly agree
8

9 I have been able to request and take the study leave I wanted?
10

- 11 Strongly disagree
12 Disagree
13 Neutral
14 Agree
15 Strongly agree
16

17 Over the past month, roughly how often have you found yourself feeling overwhelmed with work during a clinical
18 shift?
19

- 20 Rarely
21 A few times a month
22 Once a week
23 A few times a week
24 Everyday
25

26 Do you consider yourself to have any long-term health conditions or disability?
27

- 28 Yes
29 No
30 Prefer not to say
31

32 Do you have significant caring responsibilities outside of work?
33 (e.g. parent or main carer for a relative)
34

- 35 Yes
36 No
37 Prefer not to say
38

39 I feel at high risk of burnout from my job in the near future?
40

- 41 Yes
42 No
43 Prefer not to say
44

45 I feel I am currently suffering burnout from work?
46

- 47 Yes
48 No
49 Prefer not to say
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TIRED Site Survey

Department Demographics

Name of emergency department and NHS trust?

Number of attendances per year?

Any specialist designation?

- Trauma unit
 Adult major trauma centre
 Stroke centre
 PCI centre
 Paediatric major trauma centre

Number of EM Consultants?

Number of EM Middle Grades (ST4 and above)?

Number of EM Middle grade career clinicians equivalent to > ST4 (eg associate specialist, specialty doctors, CESR or other non-training doctors)?

Number of EM trainees ST3?

Number of ACCS trainees ST1-2?

Number of GP trainees ST1-3?

Number of ED GPs?

Number of Clinical Fellows (Fy1-ST3)?

Number of Clinical Fellows (>=ST4)?

Number of FY2s?

Number of FY1s?

Total number of ED Doctors calculated from the answers above:

1 Out of the total number of doctors above, how many
2 will be ineligible for the study due to absence
3 during the study period? (eg maternity, sick or
4 annual leave) _____
5

6 What percentage of eligible EM doctors do you
7 estimate you will enrol in the survey? (ie if you
8 have 50 doctors and think you will enrol 25 at your
9 site, that would be 50%). _____

(We are aiming for a response rate of 80% of
eligible doctors as a minimum at each site but
understand this not might be achievable.
Therefore, this is an opportunity to document how
many you think will be achievable at your site.)

14 Number of advanced nurse practitioners? _____
15
16

18 Number of advanced clinical practitioners? _____
19
20

21 Number of adult qualified EM nurses? _____
22
23

24 Number of paediatric qualified EM nurses? _____
25
26

28 Number of health care assistants (or equivalent)? _____
29
30

31 Number of EM physician associates? _____
32
33

34 Does your Consultant rota use self-rostering? Yes
35 No
36

38 Does your Registrar rota use self-rostering? Yes
39 No
40

41 Does your SHO rota use self-rostering? Yes
42 No
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What are the current vacancy rates for permanent staff in the following roles?

	0-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91-100%
EM consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM medical staff (excluding Consultants)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM nursing staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-medical staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What percentage of patients were seen within 4 hours in April 2019?

What percentage of patients were seen within 4 hours in March 2019?

What percentage of patients were seen within 4 hours in February 2019?

What percentage of patients were seen within 4 hours in January 2019?

What percentage of patients were seen within 4 hours in December 2018?

What percentage of patients were seen within 4 hours in November 2018?

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What are the current sickness rates for the following staff groups?

	0-1%	1-2%	2-3%	3-4%	4-5%	5-6%	6-7%	7-8%	8-9%	9-10%	>10%
EM Consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Medical Staff (excluding Consultants)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Nursing staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-Medical Staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All Staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For peer review only

What is the Minimum Shift Length for the below groups of staff?

	6 hours	7 hours	8 hours	9 hours	10 hours	11 hours	12 hours	13 hours	N/A
EM Consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Trainees, ST4 and above	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Non-training, ST4 and above	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Trainees ST3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ACCS Trainees ST1-2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GP Trainees ST1-3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clinical Fellows (FY1- ST3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clinical Fellows (>= ST4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fy2 Doctors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fy1 Doctors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For peer review only

What is the maximum shift length for the following groups of staff

	6 hours	7 hours	8 hours	9 hours	10 hours	11 hours	12 hours	13 hours	>13 hours	N/A
EM Consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Trainees, ST4 and above	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Non-trainees, ST4 and above	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Trainees, ST3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ACCS Trainees ST1-2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GP Trainees, ST1-3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clinical Fellows (FY1 - ST3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clinical Fellows (=>ST4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fy2 Doctors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fy1 Doctors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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How many hours are each of the shifts on your SHO rota?
(Select multiple if this changes depending on the shift)

	< 8 hours	8 hours	9 hours	10 hours	11 hours	12 hours	>12 hour
Day shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Night shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Twilight shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Day shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Night shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Twilight shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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How many hours are each of the shifts on your registrar rota?
(Select multiple if this changes depending on the shift)

	< 8 hours	8 hours	9 hours	10 hours	11 hours	12 hours	>12 hour
Day shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Night shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Twilight shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Day shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Night shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Twilight shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

For peer review only

How many hours are each of the shifts on your Consultant rota?

	< 8 hours	8 hours	9 hours	10 hours	11 hours	12 hours	>12 hour
Day shift (week)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Night shift (week)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Twilight shift (week)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Day shift (weekend)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Night shift (weekend)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Twilight shift (weekend)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Is there readily available rest facilities available for post night shifts? Yes
 No

Do people know how to access them? Yes
 No

Is there a break room available? Yes
 No

Online Supplementary Material 4
Table of Additional Participant Characteristics

Characteristic	N (%)	NFR Score	
		Median (95% CI) ¹	[LQ - UQ]
Maximum number of consecutive day shifts you would be scheduled to work			
0	30 (0.7)	63.6 (50.1 to 77.2)	[36.4 - 90.9]
1	42 (1.0)	59.1 (40.9 to 77.3)	[27.3 - 90.9]
2	217 (5.3)	63.6 (55.1 to 72.2)	[36.4 - 81.8]
3	522 (12.7)	63.6 (60.9 to 66.4)	[36.4 - 81.8]
4	788 (19.2)	63.6 (63.6 to 63.6)	[45.5 - 81.8]
5	1108 (27)	72.7 (70.0 to 75.5)	[45.5 - 81.8]
6	309 (7.5)	72.7 (66.9 to 78.6)	[54.5 - 90.9]
7	1094 (26.6)	72.7 (72.7 to 72.7)	[45.5 - 90.9]
Missing	137 (3.3)	72.7 (65.7 to 79.7)	[50.0 - 90.9]
Maximum number of consecutive Twilight shifts you would be scheduled to work			
0	339 (8.2)	54.5 (48.3 to 60.8)	[36.4 - 81.8]
1	341 (8.3)	60.0 (51.2 to 68.8)	[36.4 - 81.8]
2	496 (12.1)	54.5 (49.9 to 59.2)	[36.4 - 81.8]
3	796 (19.4)	63.6 (55.8 to 71.5)	[45.5 - 81.8]
4	1100 (26.7)	72.7 (69.9 to 75.5)	[45.5 - 90.9]
5	600 (14.6)	72.7 (72.1 to 73.4)	[54.5 - 90.9]
6	107 (2.6)	72.7 (67.6 to 77.8)	[54.5 - 90.9]
7	334 (8.1)	81.8 (74.4 to 89.3)	[54.5 - 90.9]
Missing	134 (3.3)	72.7 (67.3 to 78.1)	[54.5 - 90.9]
Maximum number of consecutive night shifts you would be scheduled to work			
0	1057 (25.6)	54.5 (52.0 to 57.1)	[27.3 - 80.0]
1	123 (3.0)	63.6 (53.2 to 74.0)	[36.4 - 90.9]
2	153 (3.7)	54.5 (44.7 to 64.4)	[45.5 - 81.8]
3	467 (11.3)	72.7 (65.6 to 79.9)	[45.5 - 90.9]
4	2188 (53.1)	72.7 (72.7 to 72.7)	[54.5 - 90.9]
5	64 (1.6)	72.7 (64.4 to 81.1)	[54.5 - 90.9]
6	6 (0.1)	54.5 (NA)	[45.5 - 81.8]
7	63 (1.5)	72.7 (64.4 to 81.1)	[54.5 - 90.9]
Missing	126 (3.1)	72.7 (67.4 to 78.0)	[54.5 - 90.9]
Maximum number of clinical shifts you work in a typical week?			
1	27 (0.7)	63.6 (45.2 to 82.0)	[45.5 - 90.9]
2	63 (1.5)	63.6 (49.2 to 78.1)	[36.4 - 81.8]

3	240 (5.9)	63.6 (58.1 to 69.2)	[36.4 - 81.8]
4	553 (13.5)	63.6 (54.9 to 72.3)	[36.4 - 81.8]
5	1074 (26.2)	63.6 (62.1 to 65.2)	[45.5 - 81.8]
6	858 (20.9)	72.7 (72.0 to 73.4)	[45.5 - 90.9]
7	1285 (31.3)	72.7 (72.7 to 72.7)	[45.5 - 90.9]
Missing	147 (3.6)	72.7 (67.1 to 78.3)	[45.5 - 90.9]
Non-clinical shifts past month			
0	1164 (28.3)	72.7 (72.7 to 72.7)	[54.5 - 90.9]
<1	394 (9.6)	72.7 (72.1 to 73.4)	[54.5 - 90.9]
1	525 (12.8)	72.7 (72.7 to 72.7)	[50.0 - 90.9]
2	527 (12.8)	63.6 (57.3 to 70.0)	[45.5 - 81.8]
3	242 (5.9)	63.6 (55.1 to 72.2)	[40.0 - 81.8]
4	525 (12.8)	60.0 (51.5 to 68.5)	[36.4 - 81.8]
5	115 (2.8)	54.5 (47.3 to 61.8)	[36.4 - 72.7]
6	124 (3.0)	54.5 (45.6 to 63.5)	[31.7 - 80.9]
7	39 (0.9)	63.6 (43.5 to 83.8)	[36.4 - 81.8]
8	157 (3.8)	54.5 (45.2 to 63.9)	[36.4 - 81.8]
9	19 (0.5)	60.0 (34.6 to 85.4)	[27.3 - 72.7]
10	102 (2.5)	54.5 (45.2 to 63.9)	[36.4 - 80.0]
11-15	86 (2.1)	54.5 (44.7 to 64.4)	[27.3 - 72.7]
>15	91 (2.2)	63.6 (47.6 to 79.7)	[27.3 - 81.8]
Missing	137 (3.3)	72.7 (66.6 to 78.9)	[54.5 - 90.9]
Average commute in minutes			
1-10	396 (9.6)	72.7 (64.2 to 81.3)	[45.5 - 81.8]
11-20	814 (19.8)	72.7 (64.6 to 80.9)	[45.5 - 90.0]
21-30	967 (23.5)	72.7 (64.6 to 80.8)	[45.5 - 90.9]
31-40	703 (17.1)	63.6 (63.6 to 63.6)	[36.4 - 81.8]
41-50	546 (13.3)	72.7 (64.5 to 81.0)	[45.5 - 90.9]
51-60	365 (8.9)	72.7 (67.6 to 77.8)	[45.5 - 90.0]
>60	325 (7.9)	72.7 (66.9 to 78.5)	[45.5 - 90.9]
Missing	131 (3.2)	72.7 (68.4 to 77.1)	[54.5 - 90.9]
Do you have a dedicated time away from adult emergency medicine?			
No	3091 (75.2)	72.7 (67.2 to 78.3)	[45.5 - 90.9]
Yes	1020 (24.8)	63.6 (62.2 to 65.1)	[36.4 - 81.8]
Missing	136 (3.3)	72.7 (67.7 to 77.8)	[45.5 - 90.9]

Frequency and percentage, median NFR score with 95% bootstrapped confidence intervals and the inter-quartile range of participants within each category.

¹ Bootstrapped 95% confidence intervals based on 1000 replications on a minimum of 8 observations.

Online Supplementary Material 5

Summary of median quantile regression model fitted to the Need for Recovery (NFR) score with fixed effects for site, including the adjusted coefficient estimate (Adj. Coef. Est.) with corresponding 95% confidence interval (CI) and p-value.

	Adj. Coeff. Est. (95% CI)	P-value¹
Constant (baseline NFR score)	59.51 (55.53 to 63.49)	< 0.001
Gender (baseline = Male)		
• Female	3.38 (1.80 to 4.95)	< 0.001
• Other/Prefer not to say	-0.10 (-7.84 to 7.64)	0.979
Any long-term health conditions or disabilities (baseline = No)		
• Yes	8.33 (5.73 to 10.93)	< 0.001
• Prefer not to say	6.10 (1.78 to 10.43)	0.006
ED paediatrics only? (baseline = No)		
• Yes	-8.47 (-12.97 to -3.98)	< 0.001
Clinical grade (baseline = Foundation)		
• ST1-ST2	-0.20 (-2.55 to 2.16)	0.869
• > ST2	1.04 (-1.49 to 3.57)	0.421
• SASG	-1.20 (-4.32 to 1.92)	0.450
• GP	-7.33 (-15.49 to 0.83)	0.078
• Consultant	-4.94 (-7.72 to -2.17)	< 0.001
I have been able to request and take study when I wanted (baseline = Neutral)		
• Strongly disagree	3.45 (-0.19 to 7.10)	0.063
• Disagree	3.57 (0.53 to 6.61)	0.022
• Agree	-1.18 (-3.36 to 1.00)	0.290
• Strongly agree	-6.32 (-9.23 to -3.41)	< 0.001
I have been able to request and take annual when I wanted (baseline = Neutral)		
• Strongly disagree	6.42 (2.69 to 10.15)	0.001
• Disagree	1.37 (-1.73 to 4.47)	0.385
• Agree	-2.60 (-5.07 to -0.13)	0.039
• Strongly agree	-4.31 (-7.33 to -1.28)	0.005
Proportion of time spent working out of hours (baseline = 0-25%)		
• 26-50%	5.96 (3.16 to 8.76)	< 0.001
• 51-75%	10.39 (7.54 to 13.25)	< 0.001
• 76-100%	14.34 (10.92 to 17.75)	< 0.001

Need for recovery amongst Emergency Physicians in the United Kingdom and Ireland: Findings from a Trainee Emergency Research Network (TERN) survey study

Research Checklist: The Checklist for Reporting Results of Internet E-Surveys (CHERRIES)

CHERRIES CHECKLIST ADAPTED FROM:			
Eysenbach, Gunther. "Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES)." <i>Journal of medical Internet research</i> vol. 6,3 e34. 29 Sep. 2004, doi:10.2196/jmir.6.3.e34			
Item Category	Checklist Item	Explanation	Checklist Response
IRB (Institutional Review Board) approval and informed consent process	Describe survey design	Describe target population, sample frame. Is the sample a convenience sample? (In "open" surveys this is most likely.)	Outlined in 'Methods'
	IRB approval	Mention whether the study has been approved by an IRB.	Outlined in 'Ethics Approval'
	Informed consent	Describe the informed consent process. Where were the participants told the length of time of the survey, which data were stored and where and for how long, who the investigator was, and the purpose of the study?	Outlined in Survey Distribution, monitoring and recruitment
	Data protection	If any personal information was collected or stored, describe what mechanisms were used to protect unauthorized access.	Outlined in Survey Distribution, monitoring and recruitment
Development and pre-testing	Development and testing	State how the survey was developed, including whether the usability and technical functionality of the electronic questionnaire had been tested before fielding the questionnaire.	Outlined in 'Survey Development'
Recruitment process and description of the sample having access to the questionnaire	Open survey versus closed survey	An "open survey" is a survey open for each visitor of a site, while a closed survey is only open to a sample which the investigator knows (password-protected survey).	Outlined in Survey Distribution, monitoring and recruitment
	Contact mode	Indicate whether or not the initial contact with the potential participants was made on the Internet. (Investigators may also send out questionnaires by mail and allow for Web-based data entry.)	Outlined in 'Survey Distribution, monitoring and recruitment'
	Advertising the survey	How/where was the survey announced or advertised? Some examples are offline media (newspapers), or online (mailing lists – If yes, which ones?) or banner ads (Where were these banner ads posted and what did they look like?). It is important to know the wording of the announcement as it will heavily influence who chooses to participate. Ideally the survey	Outlined in 'Survey Distribution, monitoring and recruitment'

		announcement should be published as an appendix.	
Survey administration	Web/E-mail	State the type of e-survey (eg, one posted on a Web site, or one sent out through e-mail). If it is an e-mail survey, were the responses entered manually into a database, or was there an automatic method for capturing responses?	Outlined in 'Survey Distribution, monitoring and recruitment'
	Context	Describe the Web site (for mailing list/newsgroup) in which the survey was posted. What is the Web site about, who is visiting it, what are visitors normally looking for? Discuss to what degree the content of the Web site could pre-select the sample or influence the results. For example, a survey about vaccination on a anti-immunization Web site will have different results from a Web survey conducted on a government Web site	Outlined in 'Design'
	Mandatory/voluntary	Was it a mandatory survey to be filled in by every visitor who wanted to enter the Web site, or was it a voluntary survey?	Outlined in 'Survey Distribution, monitoring and recruitment'
	Incentives	Were any incentives offered (eg, monetary, prizes, or non-monetary incentives such as an offer to provide the survey results)?	No
	Time/Date	In what timeframe were the data collected?	Outlined in 'Sites and settings'
	Randomization of items or questionnaires	To prevent biases items can be randomized or alternated.	Not done
	Adaptive questioning	Use adaptive questioning (certain items, or only conditionally displayed based on responses to other items) to reduce number and complexity of the questions	Outlined in Survey Distribution, monitoring and recruitment
	Number of Items	What was the number of questionnaire items per page? The number of items is an important factor for the completion rate.	Outlined in 'Design'
	Number of screens (pages)	Over how many pages was the questionnaire distributed? The number of items is an important factor for the completion rate.	Outlined in 'Design'
	Completeness check	It is technically possible to do consistency or completeness checks before the questionnaire is submitted. Was this done, and if "yes", how (usually JavaScript)? An alternative is to check for completeness after the questionnaire has been submitted (and highlight mandatory items). If this has been done, it should be reported. All items should provide a non-response option such as "not applicable" or	Not done

		“rather not say”, and selection of one response option should be enforced.	
	Review step	State whether respondents were able to review and change their answers (eg, through a Back button or a Review step which displays a summary of the responses and asks the respondents if they are correct).	<i>Outlined in Survey Distribution, monitoring and recruitment</i>
Response rates	Unique site visitor	If you provide view rates or participation rates, you need to define how you determined a unique visitor. There are different techniques available, based on IP addresses or cookies or both.	<i>Outlined in ‘Results’</i>
	View rate (Ratio of unique survey visitors/unique site visitors)	Requires counting unique visitors to the first page of the survey, divided by the number of unique site visitors (not page views!). It is not unusual to have view rates of less than 0.1 % if the survey is voluntary	<i>Survey site contains first page of survey therefore N/A</i>
	Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)	Count the unique number of people who filled in the first survey page (or agreed to participate, for example by checking a checkbox), divided by visitors who visit the first page of the survey (or the informed consents page, if present). This can also be called “recruitment” rate.	<i>Outlined in ‘Results’</i>
	Completion rate (Ratio of users who finished the survey/users who agreed to participate)	The number of people submitting the last questionnaire page, divided by the number of people who agreed to participate (or submitted the first survey page). This is only relevant if there is a separate “informed consent” page or if the survey goes over several pages. This is a measure for attrition. Note that “completion” can involve leaving questionnaire items blank. This is not a measure for how completely questionnaires were filled in. (If you need a measure for this, use the word “completeness rate”.)	<i>Outlined in ‘Results’</i>
Preventing multiple entries from the same individual	Cookies used	Indicate whether cookies were used to assign a unique user identifier to each client computer. If so, mention the page on which the cookie was set and read, and how long the cookie was valid. Were duplicate entries avoided by preventing users access to the survey twice; or were duplicate database entries having the same user ID eliminated before analysis? In the latter case, which entries were kept for analysis (eg, the first entry or the most recent)?	<i>Not used</i>
	IP check	Indicate whether the IP address of the client computer was used to identify potential duplicate entries from the same user. If so, mention the period of	<i>Not used due to survey being completed on multi-user/single log-in computers</i>

		time for which no two entries from the same IP address were allowed (eg, 24 hours). Were duplicate entries avoided by preventing users with the same IP address access to the survey twice; or were duplicate database entries having the same IP address within a given period of time eliminated before analysis? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	
	Log file analysis	Indicate whether other techniques to analyze the log file for identification of multiple entries were used. If so, please describe.	Not done
	Registration	In "closed" (non-open) surveys, users need to login first and it is easier to prevent duplicate entries from the same user. Describe how this was done. For example, was the survey never displayed a second time once the user had filled it in, or was the username stored together with the survey results and later eliminated? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	N/A
Analysis	Handling of incomplete questionnaires	Were only completed questionnaires analyzed? Were questionnaires which terminated early (where, for example, users did not go through all questionnaire pages) also analyzed?	Outlined in 'Data Analysis'
	Questionnaires submitted with an atypical timestamp	Some investigators may measure the time people needed to fill in a questionnaire and exclude questionnaires that were submitted too soon. Specify the timeframe that was used as a cut-off point, and describe how this point was determined	N/A
	Statistical correction	Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for the non-representative sample; if so, please describe the methods.	Outlined in 'Data Analysis'

BMJ Open

Need for recovery amongst Emergency Physicians in the United Kingdom and Ireland: a cross-sectional survey

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Primary Subject Heading:	Emergency medicine
Secondary Subject Heading:	Medical management, Occupational and environmental medicine, Health services research
Keywords:	ACCIDENT & EMERGENCY MEDICINE, HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Human resource management < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, Organisation of health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, OCCUPATIONAL & INDUSTRIAL MEDICINE

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3 1 **Need for recovery amongst Emergency Physicians in the United**
4 **Kingdom and Ireland: a cross-sectional survey**
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11 7 LATOUR, RN, PhD; On behalf of the Trainee Emergency Research Network
12 8 (TERN) and Paediatric Emergency Research in the UK and Ireland (PERUKI).
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12 40 The list of Trainee Emergency Research Network and Paediatric Emergency
13
14 41 Research in the UK and Ireland collaborators is included at the end of the
15
16 42 statements section.

17
18 43

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58 64

59
60 65 **Keywords:** Emergency Medicine; Human resource management;

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62 66 Organisation of health services; Occupational and Industrial medicine.

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64 67

1
2
3 68 **ABSTRACT**
4

5 69 **Objectives:** To determine the need for recovery (NFR) among Emergency
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7
8 70 Physicians and to identify demographic and occupational characteristics
9
10 71 associated with higher NFR scores.
11

12 72 **Design:** Cross-sectional electronic survey.
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14 73 **Setting:** Emergency Departments (ED) (n=112) in the United Kingdom and
15
16
17 74 Ireland.
18

19 75 **Participants:** Emergency Physicians, defined as any registered physician
20
21 76 working principally within the ED, responding between June-July 2019.
22

23 77 **Main outcome measure:** NFR scale, an 11-item self-administered
24
25
26 78 questionnaire that assesses how work demands affect inter-shift recovery.
27

28 79 **Results:** The median NFR score for all 4247 eligible, consented participants
29
30 80 with a valid NFR score was 70.0 (95% CI: 65.5 to 74.5), with an IQR of 45.5–
31
32
33 81 90.0. A linear regression model indicated statistically significant associations
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35 82 between gender, health conditions, type of ED, clinical grade, access to
36
37 83 annual and study leave, and time spent working out-of-hours. Groups
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39 84 including male physicians, consultants, General Practitioners within the ED,
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41 85 those working in paediatric EDs and those with no long-term health condition
42
43 86 or disability had a lower NFR score. After adjusting for these characteristics,
44
45 87 the NFR score increased by 3.7 (95% CI: 0.3 to 7.1) and 6.43 (95% CI: 2.0 to
46
47 88 10.8) for those with difficulty accessing annual and study leave, respectively.
48
49 89 Increased percentage of out-of-hours work increased NFR score almost
50
51 90 linearly: 26-50% out-of-hours work = 5.7 (95% CI: 3.1 to 8.4); 51-75% out-of-
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53 91 hours work = 10.3 (95% CI: 7.6 to 13.0); 76-100% out-of-hours work = 14.5
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56 92 (95% CI: 11.0 to 17.9).
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3 93 **Conclusion:** Higher NFR scores were observed among Emergency
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5 94 Physicians than reported in any other profession or population to date. Whilst
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7 95 out-of-hours working is unavoidable, the linear relationship observed suggests
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9 96 that any reduction may result in NFR improvement. Evidence-based
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11 97 strategies to improve well-being such as proportional out-of-hours working
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13 98 and improved access to annual and study leave should be carefully
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15 99 considered and implemented where feasible.
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3 118 **ARTICLE SUMMARY**

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5 119
6 120 **Strengths and limitations of this study**

- 7 121
8 122
9 123 • This is the first study evaluating the need for recovery (NFR) scale within a
10
11 large healthcare population.
12 124
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14 125
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16 126 • The inclusion of responses from over half of all UK Emergency
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18 Departments indicates the results are likely to be generalisable.
19 127
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21 128
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23 129 • The high volume of responses, with over half of study sites exceeding 70%
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25 participant response rates, indicates that the NFR scale is an acceptable
26 130
27 measurement tool for physicians.
28 131
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30 132
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32 133 • The study is limited by the single-point of time measurement therefore
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34 seasonal bias cannot be excluded and further assessment of test-retest
35 134
36 reliability is desirable.
37 135
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39 136
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41 137 • The use of self-administered dichotomous questionnaires is acknowledged
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43 to limit wider insights into physician recovery and well-being.
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139 INTRODUCTION

140 Recruitment and retention challenges in acute care pose a significant and
141 ongoing threat to effective healthcare provision. The need to maintain a healthy
142 and sustainable workforce is vital to safeguard future services.[1] Physician
143 well-being is a key influence on retention, with low job satisfaction and high
144 levels of stress directly leading to concern over job sustainability.[2–4] Globally,
145 high rates of physician burnout are increasingly recognised, along with the
146 consequent negative impact on delivery of high quality patient care.[5–10]

147 The Need for Recovery (NFR) scale measures the subjective perception
148 of the need to recuperate from physical and mental demands of a working day,
149 and is a suitable tool with which to assess the early symptoms of fatigue in shift
150 workers.[11,12] Within unscheduled care settings such as emergency
151 medicine, shift work is often of high intensity, and additional factors such as
152 department crowding, pressured resources and inability to control patient
153 volume may also influence NFR. Where fatigue does occur and cannot be
154 sufficiently recovered between shifts, the effect is cumulative and may lead to
155 increased occupational stress and impaired long-term health.[13,14]

156
157 Burnout inventories are increasingly utilised as an attempt to measure
158 physician well-being.[15] Although they provide valuable insight into well-
159 being, they are not without issue. Limitations include variability in burnout
160 definitions, time required for completion, ease of completion, respondent
161 survey fatigue, and difficulty translating results into intervention.[16,17,18]
162 Additionally, these methods quantify established burnout; once this has
163 occurred the human and financial resource impact is already immense, with

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3 164 associated workforce depletion and negligible mitigation strategies.[19,20]
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5 165 The identification of those clinicians *at risk* of burnout, at an early timepoint
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7 166 when interventions may be effective, presents a critical challenge.
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12 168 Increasing NFR is associated with the likelihood of progression to
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14 169 occupational burnout and health complaints, with negative effects cumulative
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16 170 over time in several validation studies [11,13]. Increased NFR may therefore
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18 171 precede the onset of sustained occupational burnout, and offer advantages
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20 172 over other burnout inventories as a simple quantifiable metric obtained through
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22 173 a rapid, standalone, and repeatable 11-item questionnaire. A single centre
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24 174 study assessing the utility of the NFR in an ED population reported a high
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26 175 response rate (80%) and completion time of less than 10 minutes whilst gaining
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28 176 insight into shift patterns, work-life balance and well-being [21]. This might
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30 177 suggest that the method of questioning used in the NFR scale and emphasis
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32 178 on recovery as opposed to more emotive questioning could be beneficial in
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34 179 improving response rates and reducing respondent fatigue in repeat usage. As
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36 180 such, NFR may provide a valuable option for regular evaluating of staff well-
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38 181 being and identifying opportunity for early intervention in busy EDs. Staff well-
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40 182 being is the fourth highest Emergency Medicine (EM) Research Priority
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42 183 identified by the James Lind Alliance Priority Setting Partnership, involving
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44 184 patients, carers and physicians.[22].
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48 186 We therefore aimed to determine the NFR among Emergency
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50 187 Physicians in EDs in the UK and Ireland, and identify demographic and
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52 188 occupational characteristics associated with higher NFR scores that might
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3 189 allow for early targeted intervention to improve physicians' well-being and
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5 190 reduce burnout.
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10 192 **METHODS**

11
12 193 This cross-sectional electronic survey study targeted a representative sample
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14 194 of Emergency Physicians working across the UK and Ireland, and was
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16 195 performed and reported in line with the Checklist for Reporting Results of
17
18 196 Internet E-surveys.[23] The study was registered at ISRCTN
19
20 197 (<https://doi.org/10.1186/ISRCTN21869845>). Ethical approval was obtained
21
22 198 from the UK Health Research Authority (Reference: 19/HRA/2404) alongside
23
24 199 equivalent approvals in Scotland, Northern Ireland and Ireland.
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31 201 **Settings and Participants**

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33 202 An initial sample of 100 EDs was deemed necessary to ensure inclusion of
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35 203 greater than 50% of Type 1 EDs, defined as 'an EM consultant-led 24-hour
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37 204 service with full resuscitation facilities', in England. [24] The study was
38
39 205 coordinated via the UK Trainee Emergency Research Network (TERN) and
40
41 206 delivered in collaboration with Paediatric Emergency Research in the UK and
42
43 207 Ireland (PERUKI) and Ireland TERN. [25, 26] Signposting to the survey and
44
45 208 enrolment of participants was led by site principal investigators (PI), who were
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47 209 provided with standardised study documentation. Local and national promotion
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49 210 of the study was conducted at professional meetings, through social media,
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51 211 national newsletters, and using the Clinical Research Network infrastructure.
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56 212 Physicians of any grade who were registered with either the UK General
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58 213 Medical Council or Irish Medical Council, and who were employed within a
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3 214 participating ED, were invited to participate. For the purposes of this study, the
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5 215 term Emergency Physician is defined as all doctors working within the ED. This
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7 216 included; doctors specialising in EM, comprising six years of postgraduate
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9 217 training for full qualification to achieve the grade of Emergency Medicine
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11 218 consultant, or non-EM specialists undertaking rotations in the ED as part of their
12
13 219 professional training, including those in the first and second year of
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15 220 postgraduate training and physicians undertaking training in General Practice,
16
17 221 Anaesthesia and Acute Medicine who commonly undertake a four to six month
18
19 222 ED rotation (Online Supplementary Material 1). Physicians who did not hold a
20
21 223 permanent contract with a participating hospital (such as those working ad-hoc
22
23 224 locum shifts), those on leave during the study period, and those in a non-clinical
24
25 225 role were excluded.

226 **Survey Development**

227 The NFR scale consists of 11 items each requiring a dichotomous 'yes' or 'no'
228 response, originally developed as a subscale of the Dutch Questionnaire on the
229 Experience and Evaluation of Work (QEEW) (Online Supplementary material
230 2, page 10).[27] Indicators of fatigue such as reduced motivation for activities
231 and concentration at the end of a working day are assessed to measure the
232 effect of work demands experienced. A 'yes' response to an item, with the
233 exception of question four which is reversed, signals an unfavourable situation.
234 The total sum of the unfavourable responses is multiplied by 100 and divided
235 by the total number of scale items, 11, producing an overall score between 0
236 and 100, with a higher score denoting a greater NFR and increased short-term
237 work-related fatigue. The NFR has previously been demonstrated to have an
238 overall Cronbach's alpha of 0.88, a measure of internal consistency and

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3 239 questionnaire reliability, with a range of 0.81 to 0.92 in subgroup analyses of
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5 240 the same validation study.[28] Following a minor amendment to one question
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7 241 to increase applicability to the study population (from 'After the evening meal, I
8
9 242 generally feel in good shape' to 'After my breaks I feel fresh to continue my
10
11 243 work'), feasibility work in a single UK centre demonstrated a Cronbach's alpha
12
13 244 of 0.79, and found that the NFR scale was acceptable and user-friendly. [21]
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17 245 A patient and public involvement (PPI) consultation was conducted at
18
19 246 the UK Emergency Medicine Trainee Association Conference (Cardiff,
20
21 247 December 2018), using a semi-structured question guide for mixed focus
22
23 248 groups to review a proposed participant survey. A key element of this
24
25 249 consultation explored the use of a burnout inventory within the proposed study;
26
27 250 concerns relating to respondent fatigue, length of survey and assessment of
28
29 251 questions using a Likert scale indicated that such an inventory was not
30
31 252 universally acceptable to Emergency Physicians. Based on this consultation,
32
33 253 the final participant survey included the 11-item NFR scale used in the feasibility
34
35 254 work and 44-items collecting the participants' demographic, occupational and
36
37 255 perceived well-being characteristics (Online Supplementary Material 2).
38
39 256 Questions relating to 'out-of-hours' work were defined as work outside of
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41 257 normal working office hours (9am until 5pm, Monday to Friday).
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47 258 A separate site-specific survey was developed de novo with expert input
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49 259 from experienced EM physicians, consisting of 39-items identified from the
50
51 260 literature and/or consensus of the study team, which explored departmental,
52
53 261 rota pattern and staffing characteristics likely to provide context for analysis and
54
55 262 interpretation of individual survey results (Online Supplementary Material 3).
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3 263 Only one site-specific survey was required per participating centre and was
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5 264 completed by the site PI.
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8 265 **Survey Distribution, monitoring and recruitment**

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10 266 All participants were provided with an information sheet, and consented to
11
12 267 participation prior to completing the survey; this was voluntary, anonymous, and
13
14 268 no incentives were given. Respondents were able to review and change their
15
16 269 answers prior to final submission of the survey. Branching logic was used for
17
18 270 responses to certain questions. Data were collected during a six-week period
19
20 271 from 3rd June 2019. During this period, advertisement of the survey and weekly
21
22 272 reminders were sent out via site PIs. The participant and site-specific surveys
23
24 273 were open surveys accessed through a link and hosted on a research specific
25
26 274 electronic survey platform, Research Electronic Data Capture platform
27
28 275 ('REDCap'; University of Bristol), which complies with European General Data
29
30 276 Protection Regulations.[29,30]
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34
35 277 Prior to study commencement, site PIs provided a best estimate of
36
37 278 eligible participants which accounted for local physician absence due to
38
39 279 sickness, leave, and factors such as sabbaticals and professional
40
41 280 secondments. This denominator was used to give a best-estimate of the per-
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43 281 site survey response rate, with a stated aim of achieving a 70% response rate.
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47 282 **Statistical Analysis**

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49 283 Statistical analysis was undertaken using STATA 14. [31] Participants were
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51 284 only included in any of the reported analyses if they were from one of the 112
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53 285 registered sites and provided a response for at least eight of the 11 items of the
54
55 286 NFR scale as per imputation guidelines. Imputation was performed by replacing
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57 287 missing items with the mean of all completed item responses. [32]
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3 288 As one item in the NFR scale was amended due to applicability to the
4
5 289 study population, the internal consistency of the NFR scale for all participants
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8 290 with a valid NFR score was calculated by Cronbach's alpha.
9

10 291 To describe the study sample, the frequency and percentage of
11
12 292 participants by site, demographic and occupational characteristics are reported.
13
14 293 As the distribution of the NFR score in this study was negatively skewed,
15
16
17 294 summary statistics of the median NFR score are reported with corresponding
18
19 295 bootstrapped 95% confidence intervals from 1000 replications (providing there
20
21 296 are at least 8 observations to allow for sufficient number of sample
22
23 297 combinations), and inter-quartile ranges (IQR) of all eligible participants. Box
24
25
26 298 plots were used as visual aids to identify covariates that may have a statistically
27
28 299 significant association with the NFR score and the nature of the relationship.
29

30 300 To facilitate comparisons with previous published literature and given
31
32 301 the large number of participants, we fitted Gaussian, mixed effects, linear
33
34 302 regression models to NFR score, where site was included as a random effect
35
36 303 to account for potentially unknown differences between EDs. To identify
37
38 304 statistically significant associations between the NFR score and observed
39
40 305 covariates, the forward model selection procedure was implemented; inclusion
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42 306 in the model was based upon the goodness of fit test at the 5% level of
43
44 307 significance, using only participants with complete NFR score and covariate
45
46 308 data. The final model was estimated using participants with complete data for
47
48 309 the included covariates and NFR score, with the coefficient estimate calculated
49
50 310 by adjusting for all covariates reported in the model. Quantile regression was
51
52 311 used to confirm the direction and significance of the identified associations
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54 312 under non-parametric assumptions.
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314 **RESULTS**

315 Characteristics of the 112 participating sites are presented in table 1.

316 **Table 1: Characteristics of sites registered to take part in the survey study**

Site Characteristics	N (%) Total = 112
Country	
England	89 (79.5)
Wales	3 (2.7)
Northern Ireland	3 (2.7)
Scotland	12 (10.7)
Republic of Ireland	5 (4.4)
ED Annual Attendance	
≤ 50,000	11 (9.8)
50,001 to 100,000	46 (41.1)
>100,000	42 (37.5)
<i>Missing</i>	13 (11.6)
Specialist Designation	
Trauma Unit (TU)	55 (49.1)
Major Trauma Centre (MTC)	25 (22.3)
Stroke Centre	42 (37.5)
PCI Centre	30 (26.8)

317

318 *ED Emergency department*319 *TU In the UK National Health Service, a hospital that provides care for all except the most*
320 *severe major trauma patients. May provide initial stabilisation of severely injured patients prior*
321 *to transfer to an MTC.*322 *MTC A specialist (tertiary) centre responsible for care of the most severely injured patients.*323 *PCI Percutaneous Coronary Intervention*

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326

327 Of 5107 unique visits to the online survey, 4365 of these were registered at one

328 of the 112 sites and provided consent, with 4247 completing at least eight items

329 of the NFR scale. Cronbach's alpha for all participants with a valid NFR score

330 was 0.80. The median NFR score across all eligible participants was 70.0 (95%
 331 CI: 65.5 to 74.5), with an IQR of 45.5 – 90.0. Figure 1 and Figure 2, and tables
 332 2 and 3 present a selection of participant's NFR score by demographic and
 333 occupational characteristics, with additional characteristics presented in the
 334 Online Supplementary Material 4.

335 **Table 2: Summary statistics of NFR score by participant's characteristics.** Frequency
 336 and percentage, median Need for Recovery (NFR) score with 95% bootstrapped confidence
 337 intervals and the inter-quartile range of participants within each category.

Participant Characteristics	N (%)	NFR Score	
		Median (95% CI)	[LQ - UQ]
All participants	4247 (100)	70.0 (62.0 to 78.0)	[45.5 - 90.0]
Length of time worked in current ED (months)			
0 to 3	740 (17.5)	72.7 (71.7 to 73.8)	[45.5 - 90.9]
> 3 to 6	848 (20.0)	72.7 (72.7 to 72.7)	[54.5 - 90.9]
> 6 to 12	729 (17.2)	72.7 (64.7 to 80.7)	[45.5 - 90.9]
> 12 to 24	370 (8.7)	63.6 (58.8 to 68.4)	[45.5 - 90.9]
> 24 to 60	583 (13.8)	63.6 (62.2 to 65.1)	[36.4 - 81.8]
> 60 to 120	497 (11.7)	63.6 (56.7 to 70.5)	[36.4 - 81.8]
> 120	473 (11.2)	54.5 (46.6 to 62.5)	[36.4 - 81.8]
Missing	7 (0.2)	18.2 (NA) ¹	[9.1 - 54.5]
Type of contract			
100%	3445 (83.5)	72.7 (67.1 to 78.4)	[45.5 - 90.9]
90%	72 (1.7)	63.6 (54.0 to 73.3)	[36.4 - 81.8]
80%	200 (4.8)	63.6 (61.4 to 65.8)	[45.5 - 81.8]
70%	116 (2.8)	72.7 (63.6 to 81.9)	[50.0 - 81.8]
60%	142 (3.4)	63.6 (54.4 to 72.9)	[45.5 - 90.9]
50%	85 (2.1)	63.6 (53.5 to 73.7)	[36.4 - 81.8]
< 50%	66 (1.6)	50.0 (35.7 to 64.3)	[27.3 - 81.8]
Missing	121 (2.9)	72.7 (67.8 to 77.7)	[54.5 - 90.9]
Significant caring responsibilities outside of work			
No	2616 (63.6)	72.7 (68.5 to 77.0)	[45.5 - 90.9]
Yes	1427 (34.7)	63.6 (62.8 to 64.5)	[36.4 - 81.8]
Prefer not to say	73 (1.8)	81.8 (71.0 to 92.7)	[54.5 - 90.9]
Missing	131 (3.2)	72.7 (68.2 to 77.3)	[54.5 - 90.9]

338 ¹ Insufficient observations for Bootstrapped 95% confidence intervals based

339 **Table 3: Summary statistics of NFR score by occupational characteristics.** Frequency
 340 and percentage, median Need for Recovery (NFR) score with 95% bootstrapped confidence
 341 intervals and the inter-quartile range of participants within each category.
 342

Occupational	N (%)	NFR Score
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Characteristics		Median (95% CI) ¹	[LQ - UQ]
All participants	4247 (100)	70.0 (62.0 to 78.0)	[45.5 - 90.0]
scheduled weekend work frequency			
1 in 2	1479 (36.0)	72.7 (72.3 to 73.2)	[54.5 - 90.9]
1 in 3	865 (21.1)	72.7 (68.1 to 77.4)	[45.5 - 90.9]
1 in 4	542 (13.2)	63.6 (57.1 to 70.2)	[45.5 - 81.8]
1 in 5	310 (7.5)	54.5 (48.4 to 60.7)	[36.4 - 81.8]
1 in 6	485 (11.8)	54.5 (49.8 to 59.3)	[27.3 - 81.8]
< 1 in 6	307 (7.5)	63.6 (55.2 to 72.1)	[36.4 - 81.8]
None	121 (2.9)	54.5 (45.7 to 63.4)	[27.3 - 81.8]
Missing	138 (3.4)	72.7 (65.9 to 79.6)	[45.5 - 90.9]
Maximum number of consecutive clinical shifts scheduled to work			
1	52 (1.3)	63.6 (45.1 to 82.2)	[27.3 - 90.9]
2	190 (4.6)	54.5 (47.6 to 61.5)	[27.3 - 72.7]
3	465 (11.3)	63.6 (60.3 to 67.0)	[36.4 - 81.8]
4	783 (19)	63.6 (63.0 to 64.3)	[45.5 - 81.8]
5	827 (20.1)	72.7 (66.2 to 79.3)	[45.5 - 81.8]
6	389 (9.5)	72.7 (67.3 to 78.2)	[45.5 - 90.0]
7	855 (20.8)	72.7 (70.8 to 74.6)	[45.5 - 90.9]
8	554 (13.5)	72.7 (66.5 to 78.9)	[54.5 - 90.9]
Missing	132 (3.2)	72.7 (67.9 to 77.6)	[54.5 - 90.9]

¹ Bootstrapped 95% confidence intervals based on 1000 replications on a minimum of 8 observations.

Only 7.5% of the participants were aged over 50 years, and the majority were aged between 26 and 30 years (28.6%). NFR score appeared to decrease with age, such that those in age groups 20 to 35 years all had a median score of 72.7, age groups 36 to 55 had a median score of 63.6, and those over 55 years had a median score of 54.5 (figure 1a). There was a reasonable balance between males and females, with just over 1% who did not submit a response (missing), preferred not to say or other. Females had a higher median NFR score of 72.7 (95% CI: 70.5 to 75.0) compared with males 63.6 (95% CI: 60.8 to 66.5) (figure 1b). Within clinical grade, consultants accounted for over a quarter of the participants who (with GPs) had the lowest median NFR score of 54.5 (consultants 95% CI: 53.6 to 55.5) compared with 72.7 in all other grades (figure 1c). The majority of participants had no long-term health conditions or

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2
3 358 disability (88.6%), with a lower NFR score of 63.6 (95% CI 60.2 to 67.1)
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5 359 compared with those who did report a long-term health condition or disability
6
7 360 72.7 (95% CI: 66.2 to 79.2) (figure 1d). Most participants worked full time
8
9 361 (83.5%), but overall, the NFR score did not decrease as contract proportion
10
11 362 decreased (table 2). Over half (54.6%) had been working in their current ED for
12
13 363 1 year or less and generally had higher NFR scores compared to those present
14
15 364 for over 1 year. Less than 35% of participants declared significant caring
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17 365 responsibilities outside of work, but those who do had a lower median NFR
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19 366 score (63.6, 95% CI: 62.8 to 64.5) than those who did not (72.7, 95% CI: 68.5
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21 367 to 77.0).
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27 368 Most of the participants agreed or strongly agreed they were able to
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29 369 obtain study or annual leave when requested (68% and >73%, respectively).
30
31 370 As the ability to obtain study and annual leave on request increased, the NFR
32
33 371 score decreased from 81.8 (95% CI: 81.4 to 82.2) to 54.5 (95% CI: 49.4 to 59.7)
34
35 372 for study leave and 81.8 (95% CI: 76.4 to 87.2) to 60.0 (95% CI: 51.8 to 68.2)
36
37 373 for annual leave (figures 2a and 2b). There was evidence the NFR score
38
39 374 increased as the proportion of time working out-of-hours increased, from 54.5
40
41 375 (95% CI: 47.8 to 61.3) to 81.8 (95% CI: 75.4 to 88.3) (figure 2c). Over 75% of
42
43 376 participants spent the majority of their time in adult EM with a median NFR
44
45 377 score of 72.7 for mixed or adult only, which was higher when compared with
46
47 378 paediatrics only 63.6 (95% CI: 55.2 to 72.1) (figure 2d). Most participants
48
49 379 worked 1 in 2 weekends (36%) with a median NFR score of 72.7, which
50
51 380 decreased to 54.5 for those who did not work any weekend shifts (see table 3).
52
53 381 Over 50% reported working 5 to 8 consecutive clinical shifts and had a median
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382 NFR score of 72.7, compared with those who worked less than five who had a
383 median NFR \leq 63.6.

384 The summary statistics of the final regression model are presented in
385 table 4.

386 **Table 4: Summary of final Gaussian, mixed effects, linear regression model fitted to the**
387 **Need for Recovery (NFR) score, including the adjusted coefficient estimate (Adj. Coef.**
388 **Est.) with corresponding 95% confidence interval (CI) and p-value.**

	Adj. Coeff. Est. (95% CI) ¹	P-value ²
Constant (baseline NFR score)	59.51(55.53 to 63.49)	< 0.001
Gender (baseline = Male)		
• Female	3.40(1.80 to 4.99)	< 0.001
• Other/Prefer not to say	-0.46(-9.07 to 8.15)	0.916
Any long-term health conditions or disabilities (baseline = No)		
• Yes	8.52(5.67 to 11.36)	< 0.001
• Prefer not to say	6.24(1.52 to 10.95)	0.01
ED paediatrics only? (baseline = No)		
• Yes	-7.08(-10.4 to -3.77)	< 0.001
Clinical grade (baseline = Foundation)		
• ST1-ST2	-0.08(-2.67 to 2.51)	0.953
• > ST2	1.32(-1.37 to 4.01)	0.336
• SASG	-1.13(-4.27 to 2.02)	0.482
• GP	-8.26(-15.09 to -1.44)	0.018
• Consultant	-5.30(-8.07 to -2.53)	< 0.001
I have been able to request and take study when I wanted (baseline = Neutral)		
• Strongly disagree	4.23(-0.26 to 8.71)	0.065
• Disagree	3.72(0.29 to 7.15)	0.034
• Agree	-1.32(-3.60 to 0.96)	0.257
• Strongly agree	-6.50(-9.43 to -3.56)	< 0.001
I have been able to request and take annual when I wanted (baseline = Neutral)		
• Strongly disagree	6.43(2.03 to 10.83)	0.004
• Disagree	1.13(-2.34 to 4.61)	0.523
• Agree	-2.84(-5.54 to -0.14)	0.039
• Strongly agree	-4.89(-8.06 to -1.72)	0.002
Proportion of time spent working out-of-hours (baseline = 0-25%)		
• 26-50%	5.74(3.13 to 8.35)	< 0.001

• 51-75%	10.32(7.60 to 13.03)	< 0.001
• 76-100%	14.45(10.97 to 17.92)	< 0.001

389 ¹ Each coefficient estimate is adjusted for all other covariates in the model

390 ² Null hypothesis: Adjusted Coefficient Estimate = 0 (i.e. is there statistically significant
391 evidence this category differs from the baseline category)

392 ^{ST1-ST2} *Specialist training year 1-2 (this included physicians training in Anaesthetics, Emergency
393 Medicine, Acute Medicine and General Practice)*

394 ^{SASG} *Staff grade, associate specialist and speciality grade*

395 ^{GP} *General Practitioner working within the ED*

396

397 This model was based on 3979 participants with complete data for all the
398 included covariates. Quantile regression confirmed the direction and
399 significance of the associations remained the same (Online Supplementary
400 Material 5). Each covariate was adjusted for all other statistically significant
401 associations. The results from this model indicated there were statistically
402 significant associations between gender, health conditions, type of ED (adult
403 or paediatric), clinical grade, access to annual and study leave, and time
404 spent working out-of-hours. The model suggested that males, GPs or
405 consultants, those working in paediatrics and those with no long-term health
406 condition or disability had the lowest NFR score. The greatest increase in
407 NFR score was associated with those who reported more than a 75%
408 proportion of out-of-hours work (14.45: 95% CI 10.97 to 17.92). If participants
409 strongly agreed they were able to obtain study leave upon request this
410 reduced their NFR score by 6.5 (95% CI: 3.56 to 9.43) and annual leave could
411 reduce their NFR score 4.89 (95% CI 1.72 to 8.06).

412

413 **DISCUSSION**

414 Emergency Physicians in the UK and Ireland have a higher NFR score than
415 has been reported in any previously studied population.[11,33–37] Three

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3 416 modifiable occupational factors were significantly associated with higher NFR
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5 417 scores (poor access to annual leave, and study leave, and proportion of out-of-
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7 418 hours work), and four further non-modifiable demographic factors were
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9 419 associated with a decreased NFR score. These were the senior grade of EM
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11 420 consultant, male gender, absence of long-term health condition or disability,
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13 421 and working in a paediatric only ED.
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19 423 The NFR median score of 70 found in this study compares unfavourably with
20
21 424 multiple occupational groups and baseline population data from a large Dutch
22
23 425 validation study, [37] where the highest frequency of responses were observed
24
25 426 at the lower end of the scale. Previous measurement in shift workers (including
26
27 427 hospital nurses) showed significantly lower NFR scores, [13,33] as did studies
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29 428 of heavy goods vehicle drivers and merchant seafarers, all with average NFR
30
31 429 scores in the range 36-44. [35,36] Our findings are however congruent with our
32
33 430 own feasibility work completed in a single centre UK ED, reporting a median
34
35 431 NFR of 81.8 in all staff groups. [21] The impact of rising patient numbers and
36
37 432 overcrowding in UK and Ireland EDs is commonly reported, [38,39] but our
38
39 433 findings are the first to illustrate the impact of high work demand on physician's
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41 434 need to recuperate from work and the modifiable factors which can mitigate this
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43 435 fatigue.
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51 437 The three modifiable occupational factors represent areas of autonomy
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53 438 and control, correlating well with previous work establishing these as core
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55 439 drivers to minimise physician workplace stress and ensure well-being. [2,40,41]
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58 440 Prioritising change in these domains may result in NFR score reduction and
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3 441 reduce negative effects on health and well-being, including occupational
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5 442 burnout. Whilst out-of-hours working is inherent and unavoidable in EM, the
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7 443 linear relationship we observed suggests that any reduction may result in direct
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9 444 improvements in NFR, and evidence-based strategies such as proportional
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11 445 control of out-of-hours working, annualised rota patterns and/or provision of rest
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13 446 facilities should therefore be considered urgently.[42–44]
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19 448 As NFR does not change with seniority prior to consultant level, this
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21 449 indicates that factors that could be postulated to influence work stress in
22
23 450 postgraduate training such as increased responsibility, management roles and
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25 451 experience, appear to have a limited influence on NFR. It is therefore possible
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27 452 that the reduction in NFR seen in those at consultant level supports the
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29 453 hypothesis that broader perceptions of job autonomy and control, may be
30
31 454 explicitly linked to well-being in healthcare.[2,44] This correlates with our finding
32
33 455 that poor access to study and annual leave increases NFR, likely to be more
34
35 456 accessible at a senior level. Further areas merit exploration including the link to
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37 457 out-of-hours working, influence of night and day shift proportions and possible
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39 458 qualitative enquiry of personal experience and clinical performance.
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47 460 The relationship observed between gender and NFR is likely to be overly
48
49 461 simplistic requiring further evaluation. Presumed confounding variables
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51 462 affecting this issue (such as a primary carer role and domestic responsibilities)
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53 463 have been previously reported to be unrelated or protective against
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55 464 maladaptive fatigue and are supported with findings from this study. [45]
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3 465 Awareness of the four demographic factors identified could be important at a
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5 466 departmental planning level and increase advocacy for colleagues at greatest
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7 467 risk of impaired well-being.
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12 469 The main strength of our study is inclusion of responses from over half
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14 470 of all UK EDs, enhancing generalisability of our findings. [24] The high volume
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16 471 of responses indicate the NFR scale as an 11-item survey, is an acceptable
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18 472 measure for physicians, with over half of sites exceeding 70% response rates.
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20 473 A key weakness is the single-point-of-time measurement, as seasonal bias may
21
22 474 have affected NFR scores. Furthermore, we acknowledge the disadvantages
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24 475 of self-administered dichotomous questionnaires which may limit the richness
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26 476 of insights.[46,47] Open-ended questions may be desirable in future survey
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28 477 iterations.
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35 479 The straightforward construction and interpretation, ease of
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37 480 administration and completion confers advantages of the NFR scale over more
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39 481 complex well-being inventories allowing for quick assessment of a workforce
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41 482 NFR, especially in a busy clinical environment. Where identified to be high and
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43 483 interventions initiated such as a rota change, the NFR scale can be easily
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45 484 repeated to confirm or refute the impact, and may identify further areas resulting
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47 485 in continual improvement whilst minimising survey respondent fatigue.
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53 487 Future areas of work will include analysis of the NFR findings in
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55 488 relationship to well-being and burnout. Any future work should also include
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3 489 other ED staff groups and physician groups to gain a broader picture across
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5 490 the multi-professional team.
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10 492 In conclusion, this study provides a robust estimate of the NFR for
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12 493 Emergency Physicians in the UK and Ireland, which is higher than any
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14 494 occupation reported to date. Several potentially modifiable occupational
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16 495 characteristics were associated with higher NFR, and future work to assess the
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18 496 impact of modifying these factors will inform strategies to reduce NFR. In time
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20 497 this may lead to improved long-term physician well-being and enhanced staff
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22 498 retention.
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13 504 results.
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19 506 **Competing interests:**
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21 507 All authors have completed the ICMJE uniform disclosure form and declare: no
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30
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32
33 513 have influenced the submitted work.
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39 515 **Patient and Public Involvement statement:**
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41 516 The concept of the research was presented to over 100 members of the
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43 517 public at a Research & Development PPI Conference on 20th September
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45 518 2018. Participants were supportive of the concept of the study, and no
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47 519 concerns were raised. Further public and stakeholder engagement took place
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49 520 through a workshop held at the UK Emergency Medicine Trainees Association
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51 521 Annual Conference in December 2018, this influenced the outcome measures
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53 522 and survey design including the removal of a formal burnout inventory due to
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3 523 perceptions and experience of respondent fatigue in the target participant
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5 524 group.

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10 526 **Ethics Approval:**

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12 527 This study protocol was submitted through the Integrated Research Application
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14 528 System (IRAS), IRAS number 262048 and received proportionate ethical
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17 529 approval by the Health Research Authority and Health and Care Research
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19 530 Wales, Research Ethics Committee reference 19/HRA/2404 and equivalent
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21 531 approvals in Scotland, Northern Ireland and Ireland. All participants provided
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24 532 informed consent prior to beginning the survey

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28 534 **Data sharing:**

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30 535 De-identified participant level data by site will be made available on
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32 536 reasonable request through the study team (tern@rcem.ac.uk). Data will be
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34 537 available for researchers whose proposed use of the data has been approved
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37 538 by the study team.

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42 540 **Transparency statement:**

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44 541 The lead author, Dr Laura Cottey, and the co-authors affirm that this manuscript
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46 542 is an honest, accurate, and transparent account of the study being reported;
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48 543 that no important aspects of the study have been omitted; and that any
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50 544 discrepancies from the study as planned have been explained.

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3 547 **Dissemination to participants and related patient and public**

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5 548 **communities:**

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7 549 The authors are unable to disseminate the result of the research to study
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9 550 participants directly, but the results will be made publicly available through
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8 574 All authors approved the final version of the manuscript for submission. LC is
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12 576 promotion and participant recruitment.
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680 REFERENCES

- 681
682 1 The King's Fund. The health care workforce in England: Make or
683 Break? 2018. [https://www.kingsfund.org.uk/publications/health-care-](https://www.kingsfund.org.uk/publications/health-care-workforce-england)
684 workforce-england (accessed 27 May 2020).
685 2 UK-wide review of doctors and medical students wellbeing - GMC.
686 2019. [https://www.gmc-uk.org/about/how-we-work/corporate-strategy-](https://www.gmc-uk.org/about/how-we-work/corporate-strategy-plans-and-impact/supporting-a-profession-under-pressure/uk-wide-review-of-doctors-and-medical-students-wellbeing)
687 plans-and-impact/supporting-a-profession-under-pressure/uk-wide-
688 review-of-doctors-and-medical-students-wellbeing (accessed 27 May
689 2020).
690 3 Ramirez AJ, Graham J, Richards MA, *et al*. Mental health of hospital
691 consultants: The effects of stress and satisfaction at work. *Lancet*
692 1996;347:724–8. doi:10.1016/S0140-6736(96)90077-X
693 4 Salen P, Norman K. The Impact of Fatigue on Medical Error and
694 Clinician Wellness: A Vignette-Based Discussion. In: *Vignettes in*
695 *Patient Safety - Volume 2*. 2018. doi:10.5772/intechopen.70712
696 5 Arora M, Asha S, Chinnappa J, *et al*. Review article: Burnout in
697 emergency medicine physicians. *Emerg Med Australas* 2013;25:491–5.
698 doi:10.1111/1742-6723.12135
699 6 Han S, Shanafelt TD, Sinsky CA, *et al*. Estimating the attributable cost
700 of physician burnout in the United States. *Ann Intern Med* Published
701 Online First: 2019. doi:10.7326/M18-1422
702 7 Rotenstein LS, Torre M, Ramos MA, *et al*. Prevalence of burnout
703 among physicians a systematic review. *JAMA* 2018;320:1131–50.
704 doi:10.1001/jama.2018.12777

- 1
2
3 705 8 Shanafelt TD, Hasan O, Dyrbye LN, *et al.* Changes in Burnout and
4 706 Satisfaction with Work-Life Balance in Physicians and the General US
5 707 Working Population between 2011 and 2014. *Mayo Clin Proc*
6 708 2015;**90**:1600–13. doi:10.1016/j.mayocp.2015.08.023
7
8 709 9 The Lancet T. Physician burnout: a global crisis. *Lancet* 2019;394:93.
9 710 doi:10.1016/S0140-6736(19)31573-9
10
11 711 10 West CP, Dyrbye LN, Erwin PJ, *et al.* Interventions to prevent and
12 712 reduce physician burnout: a systematic review and meta-analysis.
13 713 *Lancet* 2016;388:2272–81. doi:10.1016/S0140-6736(16)31279-X
14
15 714 11 Sluiter JK, Van Der Beek AJ, Frings-Dresen MHW. The influence of work
16 715 characteristics on the need for recovery and experienced health: A
17 716 study on coach drivers. *Ergonomics* 1999;42:573–83.
18 717 doi:10.1080/001401399185487
19
20 718 12 Jansen NWH, Kant I, Van Amelsvoort LGPM, *et al.* Need for recovery
21 719 from work: Evaluating short-term effects of working hours, patterns and
22 720 schedules. *Ergonomics* 2003;46:664–80
23 721 doi:10.1080/0014013031000085662
24
25 722 13 Sluiter JK, De Croon EM, Meijman TF, *et al.* Need for recovery from
26 723 work related fatigue and its role in the development and prediction of
27 724 subjective health complaints. *Occup Environ Med* 2003; 60(Suppl 1):
28 725 i62–i70 doi:10.1136/oem.60.suppl_1.i62
29
30 726 14 Sluiter JK, Frings-Dresen MH, van der Beek AJ, *et al.* The relation
31 727 between work-induced neuroendocrine reactivity and recovery,
32 728 subjective need for recovery, and health status. *J Psychosom Res*
33 729 2001;50:29–37. doi:10.1016/s0022-3999(00)00213-0
34
35 730 15 GMC. General Medical Council. National training surveys 2019: Initial
36 731 findings report. 2019. [https://www.gmc-uk.org/-/media/gmc-site-](https://www.gmc-uk.org/-/media/gmc-site-images/about/national-training-surveys-initial-findings-report-20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5D0B391744B0)
37 732 [images/about/national-training-surveys-initial-findings-report-](https://www.gmc-uk.org/-/media/gmc-site-images/about/national-training-surveys-initial-findings-report-20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5D0B391744B0)
38 733 [20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5](https://www.gmc-uk.org/-/media/gmc-site-images/about/national-training-surveys-initial-findings-report-20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5D0B391744B0)
39 734 [D0B391744B0](https://www.gmc-uk.org/-/media/gmc-site-images/about/national-training-surveys-initial-findings-report-20190705_2.pdf?la=en&hash=8455783A3C4DE2CC55A38ACB9ACF5D0B391744B0) (accessed 27 May 2020).
40
41 735 16 Williamson K, Lank PM, Cheema N, *et al.* Comparing the Maslach
42 736 Burnout Inventory to other well-being instruments in emergency
43 737 medicine residents. *J Grad Med Educ*
44 738 2018;10:532–6.

- 1
2
3 739 17 Boutou A, Pitsiou G, Sourla E, Kioumis I. Burnout syndrome among
4 740 emergency medicine physicians: an update on its prevalence and risk
5 741 factors. *Eur Rev Med Pharmacol Sci* 2019 Oct;23:9058-65.
- 6
7
8 742 18 Panagioti M, Panagopoulou E, Bower P, *et al*. Controlled interventions
9 743 to reduce burnout in physicians a systematic review and meta-analysis.
10 744 *JAMA Intern Med* 2017;177:195–205.
11
12 745 doi:10.1001/jamainternmed.2016.7674
- 13
14
15 746 19 Dewa CS, Jacobs P, Thanh NX, *et al*. An estimate of the cost of burnout
16 747 on early retirement and reduction in clinical hours of practicing
17 748 physicians in Canada. *BMC Health Serv Res* 2014;14.
18
19 749 doi:10.1186/1472-6963-14-254
- 20
21
22 750 20 National Academies of Sciences E and M. *Taking Action Against*
23 751 *Clinician Burnout*. Washington, D.C. National Academies Press 2019.
24
25 752 doi:10.17226/25521
- 26
27
28 753 21 Graham B, Cottey L, Smith JE, *et al* Measuring ‘Need for Recovery’ as
29 754 an indicator of staff well-being in the emergency department: a survey
30 755 study. *Emerg Med J* Published Online First:
31 756 2020. doi: 10.1136/emered-2019-208797
- 32
33
34 757 22 Smith J, Keating L, Flowerdew L on behalf of the JLA EM PSP Steering
35 758 Group, *et al* An Emergency Medicine Research Priority Setting
36 759 Partnership to establish the top 10 research priorities in emergency
37 760 medicine. *Emerg Med J* 2017;34:454-456.
- 38
39
40 761 23 Eysenbach G. Improving the Quality of Web Surveys: The Checklist for
41 762 Reporting Results of Internet E-Surveys (CHERRIES). *J Med Internet*
42 763 *Res* 2004;6:e34. doi:10.2196/jmir.6.3.e34
- 43
44
45 764 24 Medicine RC of E. Essential Facts Regarding A&E Services.
46 765 2018.<https://www.rcem.ac.uk/docs/Policy/England Factsheet 2018.pdf>
47 766 (accessed 27 May 2020).
- 48
49
50 767 25 Cottey L, Vassallo J, Roberts T, Horner D, Tabner A. About TERN? -
51 768 RCEMLearning. <https://www.rcemlearning.co.uk/foamed/about-tern/>
52 769 (accessed 27 May 2020)
- 53
54
55 770 26 Lyttle MD, O’Sullivan R, Hartshorn S, *et al*. Pediatric Emergency
56 771 Research in the UK and Ireland (PERUKI): Developing a collaborative
57 772 for multicentre research. *Arch Dis Child* 2014;99:602–3.

- 1
2
3 773 doi:10.1136/archdischild-2013-304998
4
5 774 27 Van Veldhoven M, Meijman TF. *Het meten van psychosociale*
6
7 775 *arbeidsbelasting met een vragenlijst: De Vragenlijst Beleving en*
8
9 776 *Beoordeling van de Arbeid (VBBA). [Questionnaire on Perception and*
10
11 777 *Judgement of Work]*. 1994.
12
13 778 28 Van Veldhoven M, Broersen S. Measurement quality and validity of the
14
15 779 “need for recovery scale”. *Occup Environ Med* 2003;**60**:i3-i9.
16
17 780 doi:10.1136/oem.60.suppl_1.i3
18
19 781 29 Harris PA, Taylor R, Minor BL, *et al*. The REDCap consortium: Building
20
21 782 an international community of software platform partners. *J Biomed*
22
23 783 *Inform* 2019;**95**:103208. doi:10.1016/J.JBI.2019.103208
24
25 784 30 Harris PA, Taylor R, Thielke R, *et al*. Research electronic data capture
26
27 785 (REDCap)—A metadata-driven methodology and workflow process for
28
29 786 providing translational research informatics support. *J Biomed Inform*
30
31 787 2009;**42**:377–81. doi:10.1016/J.JBI.2008.08.010
32
33 788 31 StataCorp. Stata Statistical Software: Release 14. College Station, TX:
34
35 789 StataCorp LP. 2015. 2015. doi:10.2307/2234838
36
37 790 32 Van Der Starre RE, Coffeng JK, Hendriksen IJ, *et al*. Associations
38
39 791 between overweight, obesity, health measures and need for recovery in
40
41 792 office employees: A cross-sectional analysis. *BMC Public Health*
42
43 793 Published Online First: 2013. doi:10.1186/1471-2458-13-1207
44
45 794 33 Moriguchi CS, Trevizani T, De Fátima Carreira Moreira R, *et al*. Need
46
47 795 for recovery assessment among nursing professionals and call center
48
49 796 operators. In: *Work*. 2012. 4838–42. doi:10.3233/WOR-2012-0773-4838
50
51 797 34 Samadi H, Kalantari R, Mostafavi F, *et al*. Using the Need for Recovery
52
53 798 Scale to Assess Workload in Mine Workers and Its Relationship With
54
55 799 Demographics. *J Ergon* 2017;**4**:1–7. doi:10.21859/joe-04041
56
57 800 35 Bridger RS, Brasher K, Dew A. Work demands and need for recovery
58
59 801 from work in ageing seafarers. *Ergonomics* 2010;**53**:1006–15.
60
802 doi:10.1080/00140139.2010.493958
803 36 De Croon EM, Sluiter JK, Frings-Dresen MHW. Need for recovery after
804
805 work predicts sickness absence: A 2-year prospective cohort study in
806
806 3999(02)00630-X

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2
3 807 37 Jansen NWH, Kant IJ, van den Brandt PA. Need for recovery in the
4
5 808 working population: description and associations with fatigue and
6
7 809 psychological distress. *Int J Behav Med* 2002;9:322–40.
8
9 810 38 Hassan T, Walker B, Harrison M, *et al.*
10 811 [www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-](http://www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-October_2013.pdf)
11 812 [October_2013.pdf](http://www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-October_2013.pdf). 2013.[www.rcem.ac.uk/docs/Policy/CEM7461-](http://www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-October_2013.pdf)
12 813 [Stretched-to-the-limit-October_2013.pdf](http://www.rcem.ac.uk/docs/Policy/CEM7461-Stretched-to-the-limit-October_2013.pdf) (accessed 27 Ma7 2020).
13
14
15 814 39 The Royal College of Emergency Medicine. Improving safety in the
16 815 Emergency Department this winter: a guide for health service leaders
17 816 and boards. 2018.
18
19
20 817 [https://www.rcem.ac.uk/RCEM/Quality_Policy/Policy/Winter_Planning/R](https://www.rcem.ac.uk/RCEM/Quality_Policy/Policy/Winter_Planning/RCEM/Quality-Policy/Policy/Winter_Planning.aspx?hkey=e37845aa-c9a5-4b01-aa72-48137cc59aa1)
21 818 [CEM/Quality-Policy/Policy/Winter_Planning.aspx?hkey=e37845aa-](https://www.rcem.ac.uk/RCEM/Quality_Policy/Policy/Winter_Planning.aspx?hkey=e37845aa-c9a5-4b01-aa72-48137cc59aa1)
22 819 [c9a5-4b01-aa72-48137cc59aa1](https://www.rcem.ac.uk/RCEM/Quality_Policy/Policy/Winter_Planning.aspx?hkey=e37845aa-c9a5-4b01-aa72-48137cc59aa1) (accessed 23 July 2020)
23
24
25 820 40 Hall LH, Johnson J, Heyhoe J, *et al.* Strategies to improve general
26 821 practitioner well-being: Findings from a focus group study. *Fam Pract*
27 822 Published Online First: 2018. doi:10.1093/fampra/cmz130
28
29
30 823 41 Galletta M, Portoghese I, Fabbri D, *et al.* Empowering workplace and
31 824 wellbeing among healthcare professionals: The buffering role of job
32 825 control. *Acta Biomed* 2016;87:61–9.
33
34
35 826 42 NHS Improvement. Annualised hours rotas for emergency department
36 827 doctors. 2019.
37
38
39 828 [https://improvement.nhs.uk/documents/5919/Brighton__Sussex_-](https://improvement.nhs.uk/documents/5919/Brighton__Sussex_-_annualised_hours_rotas.pdf)
40 829 [_annualised_hours_rotas.pdf](https://improvement.nhs.uk/documents/5919/Brighton__Sussex_-_annualised_hours_rotas.pdf) (accessed 27 May 2020).
41
42
43 830 43 Rimmer A. Government commits £10m to doctors' rest facilities. *BMJ*
44 831 2233 doi: <http://doi.org/10.1136/bmj.l2233>
45
46 832 44 Smith E, Dasan S. A system under pressure. *Br J Hosp Med*
47 833 2018;79:495–9. doi:10.12968/hmed.2018.79.9.495
48
49
50 834 45 Winwood PC, Winefield AH, Lushington K. Work-related fatigue and
51 835 recovery: The contribution of age, domestic responsibilities and
52 836 shiftwork. *J Adv Nurs* 2006;56:438–49. doi:10.1111/j.1365-53 837 2648.2006.04011.x
54
55
56 838 46 Dykema J, Jones NR, Piché T, *et al.* Surveying Clinicians by Web:
57 839 Current Issues in Design and Administration. *Eval Heal Prof* Published
58
59
60 840 Online First: 2013;36:352-81. doi:10.1177/0163278713496630

841 47 Klabunde CN, Willis GB, McLeod CC, *et al.* Improving the Quality of
 842 Surveys of Physicians and Medical Groups: A Research Agenda. *Eval*
 843 *Heal Prof* 2012;35:477-506 doi:10.1177/0163278712458283

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847 Research Checklist: The Checklist for Reporting Results of Internet E-Surveys
 848 (CHERRIES)

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CHERRIES CHECKLIST ADAPTED FROM:			
Eysenbach, Gunther. "Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES)." <i>Journal of medical Internet research</i> vol. 6,3 e34. 29 Sep. 2004, doi:10.2196/jmir.6.3.e34			
Item Category	Checklist Item	Explanation	Checklist Response
Design	Describe survey design	Describe target population, sample frame. Is the sample a convenience sample? (In "open" surveys this is most likely.)	Outlined in 'Methods'
IRB (Institutional Review Board) approval and informed consent process	IRB approval	Mention whether the study has been approved by an IRB.	Outlined in 'Ethics Approval'
	Informed consent	Describe the informed consent process. Where were the participants told the length of time of the survey, which data were stored and where and for how long, who the investigator was, and the purpose of the study?	Outlined in Survey Distribution, monitoring and recruitment
	Data protection	If any personal information was collected or stored, describe what mechanisms were used to protect unauthorized access.	Outlined in Survey Distribution, monitoring and recruitment
Development and pre-testing	Development and testing	State how the survey was developed, including whether the usability and technical functionality of the electronic questionnaire had been tested before fielding the questionnaire.	Outlined in 'Survey Development'
Recruitment process and description of the sample having access to the questionnaire	Open survey versus closed survey	An "open survey" is a survey open for each visitor of a site, while a closed survey is only open to a sample which the investigator knows (password-protected survey).	Outlined in Survey Distribution, monitoring and recruitment
	Contact mode	Indicate whether or not the initial contact with the potential participants was made on the Internet. (Investigators may also send out	Outlined in 'Survey Distribution, monitoring and recruitment'

		questionnaires by mail and allow for Web-based data entry.)	
	Advertising the survey	How/where was the survey announced or advertised? Some examples are offline media (newspapers), or online (mailing lists – If yes, which ones?) or banner ads (Where were these banner ads posted and what did they look like?). It is important to know the wording of the announcement as it will heavily influence who chooses to participate. Ideally the survey announcement should be published as an appendix.	Outlined in 'Survey Distribution, monitoring and recruitment'
Survey administration	Web/E-mail	State the type of e-survey (eg, one posted on a Web site, or one sent out through e-mail). If it is an e-mail survey, were the responses entered manually into a database, or was there an automatic method for capturing responses?	Outlined in 'Survey Distribution, monitoring and recruitment'
	Context	Describe the Web site (for mailing list/newsgroup) in which the survey was posted. What is the Web site about, who is visiting it, what are visitors normally looking for? Discuss to what degree the content of the Web site could pre-select the sample or influence the results. For example, a survey about vaccination on a anti-immunization Web site will have different results from a Web survey conducted on a government Web site	Outlined in 'Design'
	Mandatory/voluntary	Was it a mandatory survey to be filled in by every visitor who wanted to enter the Web site, or was it a voluntary survey?	Outlined in 'Survey Distribution, monitoring and recruitment'
	Incentives	Were any incentives offered (eg, monetary, prizes, or non-monetary incentives such as an offer to provide the survey results)?	No
	Time/Date	In what timeframe were the data collected?	Outlined in 'Sites and settings'
	Randomization of items or questionnaires	To prevent biases items can be randomized or alternated.	Not done
	Adaptive questioning	Use adaptive questioning (certain items, or only conditionally displayed based on responses to other items) to reduce number and complexity of the questions	Outlined in Survey Distribution, monitoring and recruitment
	Number of Items	What was the number of questionnaire items per page? The number of items is an important factor for the completion rate.	Outlined in 'Design'

	Number of screens (pages)	Over how many pages was the questionnaire distributed? The number of items is an important factor for the completion rate.	Outlined in 'Design'
	Completeness check	It is technically possible to do consistency or completeness checks before the questionnaire is submitted. Was this done, and if "yes", how (usually JavaScript)? An alternative is to check for completeness after the questionnaire has been submitted (and highlight mandatory items). If this has been done, it should be reported. All items should provide a non-response option such as "not applicable" or "rather not say", and selection of one response option should be enforced.	Not done
	Review step	State whether respondents were able to review and change their answers (eg, through a Back button or a Review step which displays a summary of the responses and asks the respondents if they are correct).	Outlined in Survey Distribution, monitoring and recruitment
Response rates			
	Unique site visitor	If you provide view rates or participation rates, you need to define how you determined a unique visitor. There are different techniques available, based on IP addresses or cookies or both.	Outlined in 'Results'
	View rate (Ratio of unique survey visitors/unique site visitors)	Requires counting unique visitors to the first page of the survey, divided by the number of unique site visitors (not page views!). It is not unusual to have view rates of less than 0.1 % if the survey is voluntary	Survey site contains first page of survey therefore N/A
	Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)	Count the unique number of people who filled in the first survey page (or agreed to participate, for example by checking a checkbox), divided by visitors who visit the first page of the survey (or the informed consents page, if present). This can also be called "recruitment" rate.	Outlined in 'Results'
	Completion rate (Ratio of users who finished the survey/users who agreed to participate)	The number of people submitting the last questionnaire page, divided by the number of people who agreed to participate (or submitted the first survey page). This is only relevant if there is a separate "informed consent" page or if the survey goes over several pages. This is a measure for attrition. Note that "completion" can involve leaving questionnaire items blank. This is not a measure for how completely questionnaires were filled in. (If you need a measure for this, use the word "completeness rate".)	Outlined in 'Results'
Preventing multiple	Cookies used	Indicate whether cookies were used to assign a unique user identifier to each	Not used

<p>entries from the same individual</p>		<p>client computer. If so, mention the page on which the cookie was set and read, and how long the cookie was valid. Were duplicate entries avoided by preventing users access to the survey twice; or were duplicate database entries having the same user ID eliminated before analysis? In the latter case, which entries were kept for analysis (eg, the first entry or the most recent)?</p>	
	<p>IP check</p>	<p>Indicate whether the IP address of the client computer was used to identify potential duplicate entries from the same user. If so, mention the period of time for which no two entries from the same IP address were allowed (eg, 24 hours). Were duplicate entries avoided by preventing users with the same IP address access to the survey twice; or were duplicate database entries having the same IP address within a given period of time eliminated before analysis? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?</p>	<p>Not used due to survey being completed on multi-user/single log-in computers</p>
	<p>Log file analysis</p>	<p>Indicate whether other techniques to analyze the log file for identification of multiple entries were used. If so, please describe.</p>	<p>Not done</p>
	<p>Registration</p>	<p>In “closed” (non-open) surveys, users need to login first and it is easier to prevent duplicate entries from the same user. Describe how this was done. For example, was the survey never displayed a second time once the user had filled it in, or was the username stored together with the survey results and later eliminated? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?</p>	<p>N/A</p>
<p>Analysis</p>	<p>Handling of incomplete questionnaires</p>	<p>Were only completed questionnaires analyzed? Were questionnaires which terminated early (where, for example, users did not go through all questionnaire pages) also analyzed?</p>	<p>Outlined in ‘Data Analysis’</p>
	<p>Questionnaires submitted with an atypical timestamp</p>	<p>Some investigators may measure the time people needed to fill in a questionnaire and exclude questionnaires that were submitted too soon. Specify the timeframe that was used as a cut-off point, and describe how this point was determined</p>	<p>N/A</p>
	<p>Statistical correction</p>	<p>Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for the non-</p>	<p>Outlined in ‘Data Analysis’</p>

		representative sample; if so, please describe the methods.	
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Figure Legend

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Figure 1

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Box plots of Need for Recovery (NFR) score by participant demographic characteristics, excluding any participants who does not respond to the question (i.e. missing).

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Plot a) age group in years; b) gender; c) clinical grade; d) any long-term health condition or disability.

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ST1-ST2=Specialist Training year 1-2 (this included physicians training in

869

Anaesthetics, Emergency Medicine, Acute Medicine and General Practice)

870

SASG=Staff grade, associate specialist and speciality grade

871

GP=General Practitioner working within the emergency department (ED)

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Figure 2

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Box plot of Need for Recovery (NFR) score by participant's occupational

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characteristics, excluding any participants who does not respond to the

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question (i.e. missing).

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Plot a) ability to obtain study leave when requested; b) ability to obtain annual

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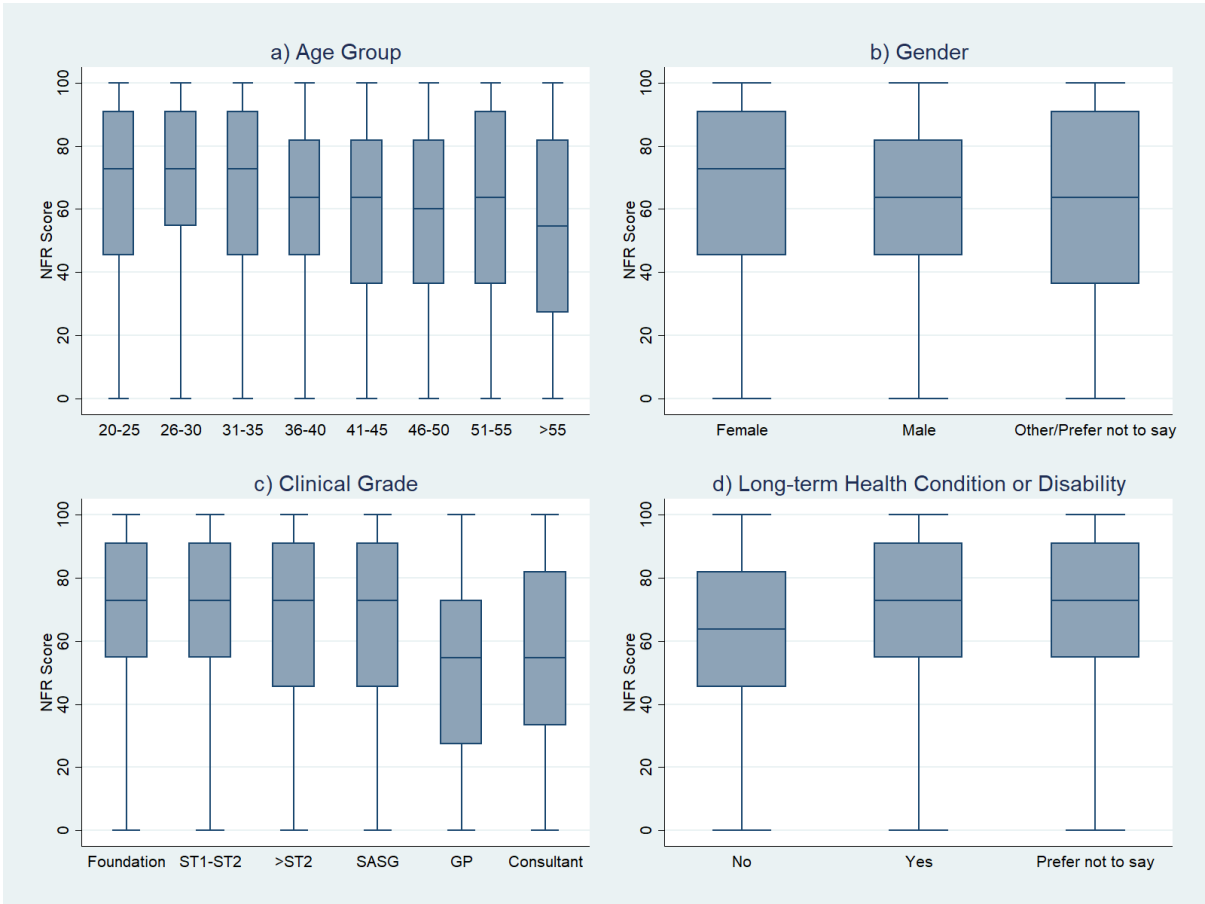
leave when requested; c) proportion of time working out-of-hours; d) working

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in paediatrics emergency departments (ED) only.

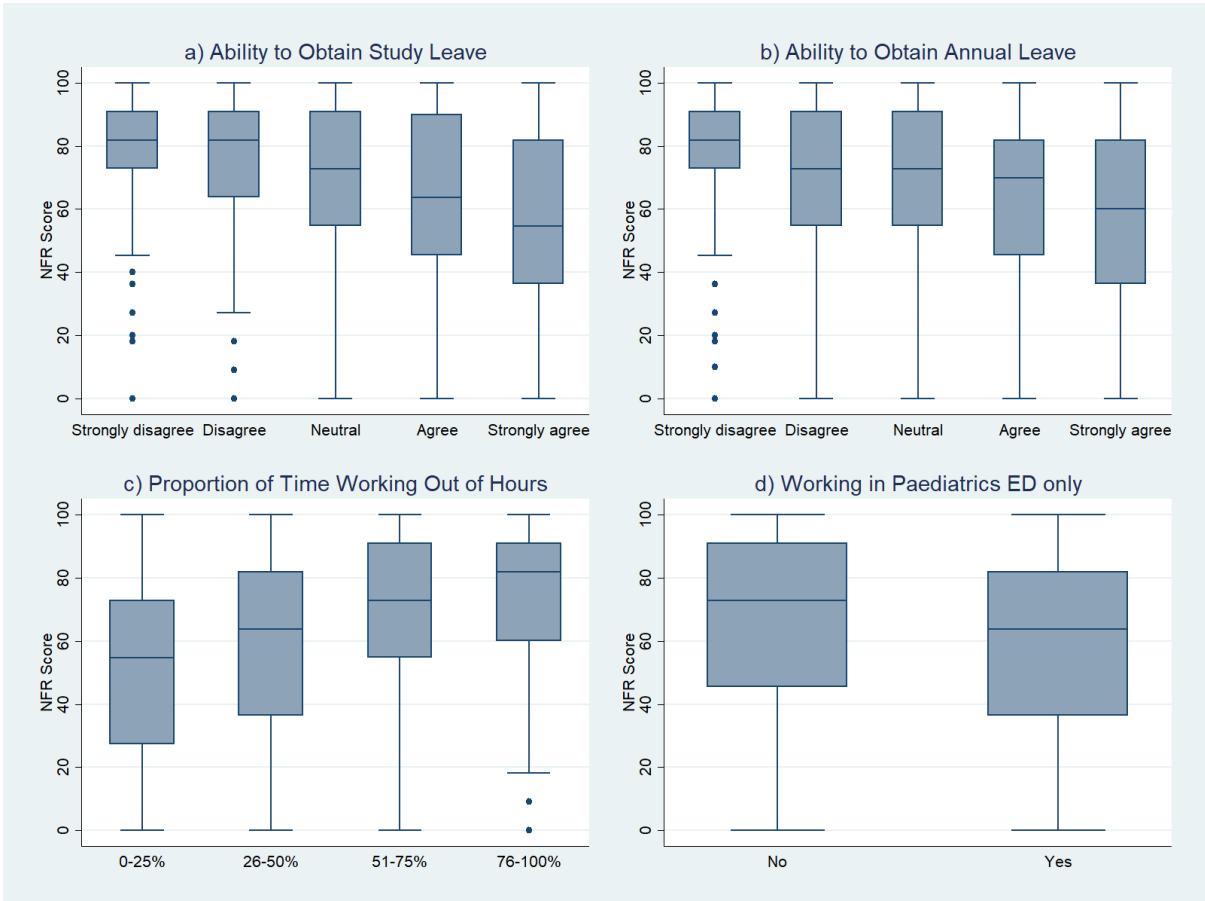
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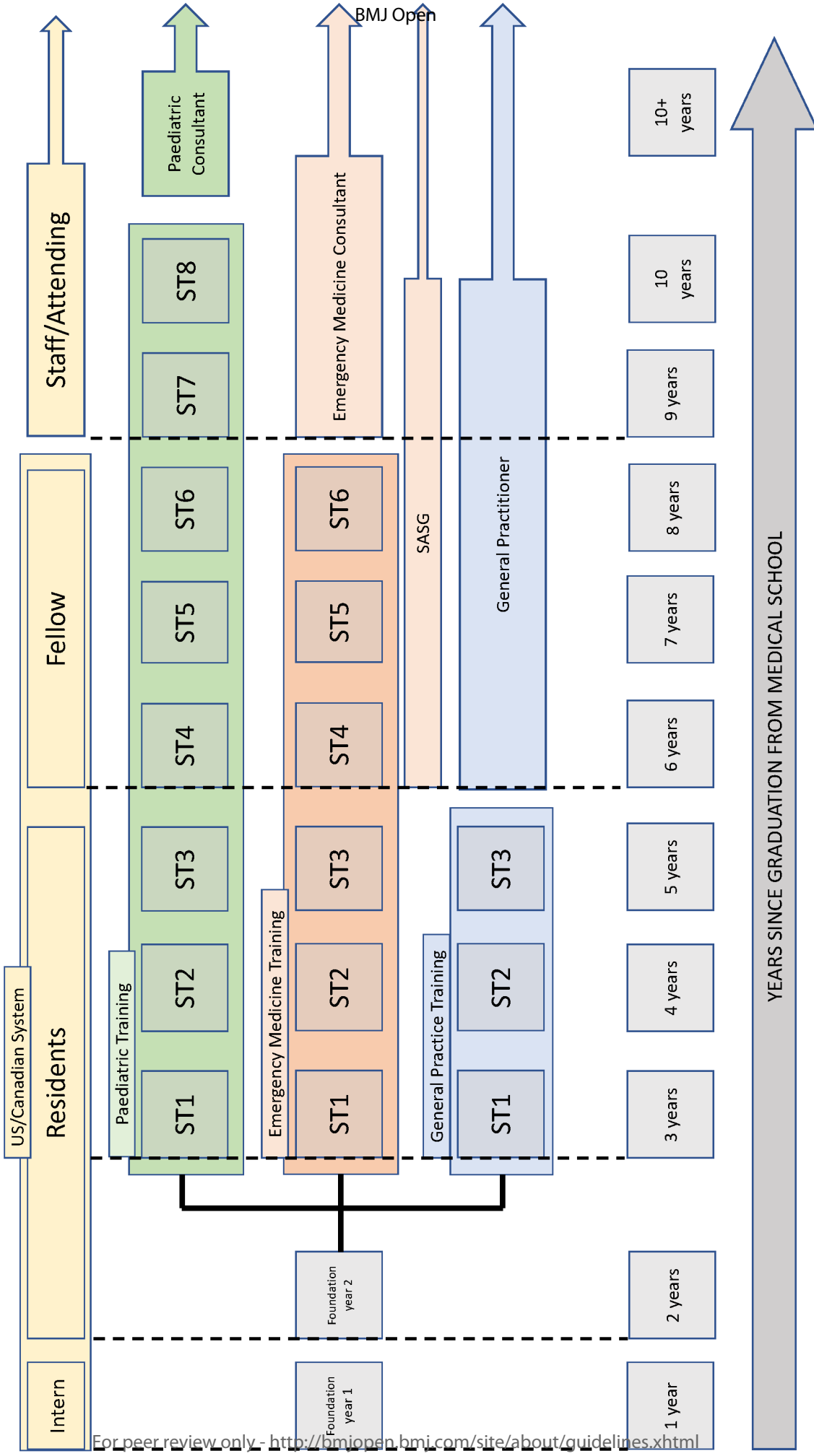
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Review only

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Emergency Department Need For Recovery Survey

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Do you want to read the patient participation leaflet, GDPR and consent information now?

- Yes
- No

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1 Participant Information Sheet

2
3 Welcome to the 2019 TERN Need for Recovery Survey.

4
5 This is an electronic participant information sheet.
6 Please take a minute or two to read this information
7 before proceeding with the survey.

8
9 What is need for recovery?

10 Need for recovery is the time taken to physically and
11 psychologically recover from work. Increased need
12 for recovery is linked to fatigue and a range of
13 physical and psychological health outcomes including
14 burnout.

15 Why have I been asked to take part?

16 You are either:

- 17 • A doctor working in an emergency department which
18 has been nominated to participate in this survey.

19 What is the purpose of the study?

20 This survey is being conducted as part of a national
21 survey by the Trainee Emergency Research Network
22 (TERN). The project is being led by Dr Laura Cottey
23 (Chief Investigator) and Dr Blair Graham, with
24 oversight from the TERN executive committee. We hope
25 that the results from this survey will provide a
26 baseline assessment of trainee need for recovery,
27 and demonstrate risk factors that may indicate an
28 increased need for recovery. It is hoped that this
29 survey will provide insight into the phenomenon of
30 need for recovery amongst Emergency Department
31 doctors, show where differences exist, and how need
32 for recovery may be reduced in the future.
33 Ultimately it is hoped that this survey may lead to
34 initiatives to improve the working lives of doctors
35 in the emergency department.

36 What will happen if I take part?

37 You will be asked to take part in this electronic
38 questionnaire. You should allocate about 5 minutes
39 to complete the questionnaire, although you can save
40 and return to completing the questionnaire at a
41 later time.

42
43 Do I have to take part?

44 In order that these results can inform future
45 initiatives to improve working lives of emergency
46 doctors, we do require a robust response rate.
47 However, you are under no obligation to take part
48 and may withdraw at any point without the need to
49 give a reason.

50 Should you have uncertainties or queries about this
51 survey, please do not hesitate to contact the study
52 team.

53
54 What will happen to my data if I withdraw my
55 involvement?

56 If you choose to withdraw your involvement in the
57 study, any results that you have submitted will be
58 kept for analysis. However, you will not be required
59 to input further into the study.

60 If you would like to be formally withdrawn from the
study at any point, please contact the study team
(TERN@rcem.ac.uk). You do not have to give a reason.

For peer review only - <http://bmjopen.bmj.com/site/about/guidelines.xhtml>

Are there any potential risks or benefits of taking

This survey will provide valuable insight into the wellbeing of emergency department doctors nationally. We appreciate issues such as wellbeing and burnout are sensitive. We have included some information about sources that you might wish to contact for support both as part of this introduction, and at the end of the survey.

Who is involved in this project?

The project is being led by Dr Laura Cottey (Chief Investigator) and Dr Blair Graham, with oversight from the TERN executive committee which is led by Dr Tom Roberts. The study is indirectly supported by the Royal College of Emergency Medicine, but TERN is independent from the college.

What if something goes wrong?

It is very unlikely that anything will go wrong. If you feel it does, please contact the study team directly.

How will you protect my data and confidentiality?

The University Hospitals Plymouth NHS Trust is the sponsor for this study. The sponsor will be using information in order to undertake the study and will be responsible for looking after your information and using it properly. The data collected will be kept for 10 years after the study has finished.

Your rights to access, change or move your information are limited, as we need to manage your information in specific ways in order for the research to be reliable and accurate. If you withdraw from the study, we will keep the information about you that we have already obtained. To safeguard your rights, we will use the minimum personally identifiable information possible.

This study is also compliant with the General Data Protection Regulations (GDPR). For more information about GDPR click here.

How may I contact the study team in the future?

You can contact the study team by emailing Dr Laura Cottey at laura.cottey@nhs.net

What to do if you need support about wellbeing

The following organisations can help provide advice and support with regards to your wellbeing.

-Your occupational health department (contact details available via your employer)

-Your general practitioner

-BMA Counselling Service (24 Hours). Telephone 0330 123 1245. (Note that you do not have to be a member of the BMA to access this service)

-The Samaritans (24 Hours). Telephone 116 123.

You can also access further information and signposting online via the Doctors Support Network <https://www.dsn.org.uk/>

Feel free to leave any comments.

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Consent Question 1: Yes
I have read and understood the participant information No

Consent Question 2: Yes
I understand the information about confidentiality and GDPR No

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Demographic Characteristics

What is your current job role?

- ST1
 ST2
 ST3
 ST4
 ST5
 ST6
 ST7
 ST8
 F1
 F2
 Clinical Fellow (F2-ST3 Level)
 Clinical Fellow (>=ST4 Level)
 Consultant
 Associate Specialist
 Staff Grade
 CESR Doctor
 GP Trainee
 GP
 Other (please specify)

What is your job role?

Which country do you work in?

- Scotland
 Northern Ireland
 Wales
 England
 Republic of Ireland

Which hospital do you currently work in?

- Aberdeen
 Victoria Hospital, Kirkcaldy
 Forth Valley Royal Hospital
 Monklands Hospital
 Royal Hospital for Children, Glasgow
 Royal Infirmary of Edinburgh
 St John's, Livingston
 NHS Greater Glasgow and Clyde - Queen Elizabeth
 NHS Greater Glasgow and Clyde - Glasgow Royal Infirmary
 Crosshouse, Ayrshire
 Royal Alexandra, Paisley
 Ayr
 Royal Hospital for Sick Children, Edinburgh
 Other

Which hospital do you currently work in?

- Craigavon Area Hospital, Northern Ireland
 Royal Victoria Hospital, Belfast
 Ulster Hospital, Belfast
 Other

1 Which hospital do you currently work in?
2

- 3 Cardiff, University Hospital of Wales
- 4 Ysbyty Gwynedd, Bangor
- 5 Morriston Hospital, Swansea
- 6 Wrexham, North Wales
- 7 Other
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For peer review only

1 Which hospital do you currently work in (the list is mostly alphabetically but if you cannot find your hospital please
2 check the bottom)?
3

- 4 Addenbrooke's Hospital
5 Aintree
6 Airedale General Hospital
7 Basingstoke Emergency Department
8 Bedford hospital emergency department
9 Birmingham
10 Bolton
11 Bradford Royal Infirmary
12 Brighton (Royal Sussex County Hospital)
13 Bristol Childrens Hospital
14 Bristol Royal Infirmary (Adults)
15 Cambridge University Hospitals
16 Chelsea & Westminster Hospital
17 Croydon University Hospital
18 Doncaster Royal Infirmary
19 William Harvey ED
20 East Surrey Hospital ED
21 Epsom and St Helier NHS Trust
22 Gloucestershire Hospitals NHS Foundation Trust
23 Great Western Hospital Swindon
24 Hampshire Hospitals NHS Trust (Basingstoke and Winchester)
25 Harrogate Emergency Department
26 Homerton Emergency Department
27 Ipswich Hospital
28 James Cook University Hospital Middlesbrough
29 James Paget University Hospital
30 Leeds teaching hospitals
31 Leicester Royal Infirmary
32 Leighton (Crewe)
33 Lewisham university hospital
34 Lister Hospital
35 QEH, London
36 Manchester Royal Infirmary
37 Milton Keynes University
38 Musgrove Park Hospital, Taunton
39 Northern general hospital
40 Northumbria Specialist Emergency Care Hospital
41 Northwick Park Hospital
42 Oxford University Hospital NHS Foundation Trust/
43 Portsmouth - Queen Alexandra Hospital,
44 Plymouth- Derriford
45 Reading
46 Royal Berkshire Hospital
47 Royal Blackburn Hospital
48 Royal Cornwall Hospital, Truro
49 Royal Devon & Exeter Hospital
50 Royal Liverpool University Hospital
51 The Royal London Hospital (Paeds)
52 The Royal London Hospital (Adults)
53 Royal Manchester Children's Hospital
54 Royal Oldham Hospital
55 Royal Preston hospital
56 Royal Shrewsbury Hospital
57 Royal Stoke
58 Royal Surrey County Hospital
59 Royal United Hospital Bath
60 Royal Victoria, Newcastle
 Salford Royal Hospital, Manchester
 Sheffield Childrens Hospital ED
 Medway Foundation NHS Trust
 Mid Cheshire Hospitals NHS Foundation Trust
 University Hospital Southampton
 St Helens and Knowsley
 Southmead Hospital
 Surrey and Sussex Healthcare NHS Trust
 St George's Hospital Tooting

For peer review only

- 1 St Marys Hospital, London
2 St Richards hospital
3 St Thomas' Hospital
4 Torbay
5 Tunbridge Wells Hospital
6 Southport District General Hospital
7 University College Hospital, London
8 University Hospital Coventry and Warwickshire
9 Warrington
10 University Hospitals of Derby and Burton NHS Foundation Trust
11 Watford General hospital
12 West Middlesex University Hospital
13 West Suffolk Hospital
14 Frimley Park Hospital
15 Wexham Park Hospital, Frimley Health NHS
16 Whiston Hospital
17 Wythenshawe Hospital
18 Yeovil District Hospital
19 York District hospital
20 York Hospital Emergency Departments
21 Whiston Hospital
22 William Harvey Hospital
23 Worthing Hospital
24 University hospital of Hull
25 North Middlesex
26 Sandwell and West Birmingham
27 Stoke Mandeville
28 Colchester
29 Alder Hey Children's Hospital
30 Queen's Hospital, Romford
31 Birmingham Children's Hospital
32 Sunderland Royal Hospital
33 Countess of Chester NHS foundation trust
34 University hospital of North Durham
35 Evelina Children's Hospital
36 King's College, London
37 Barnstaple
38 Nottingham University Hospital
39 Royal Alexandra Children's Hospital
40 Royal Wolverhampton
41 Salisbury NHS Trust
42 Western Sussex NHS Trust
43 Other
44 Alder Hey Childrens Hospital
45 Birmingham Women's and Childrens Hospital
46 Countess of Chester
47 Evelina, Guys and St Thomas's
48 Kings College Hospital
49 Royal Alexandra Children's Hospital, Brighton and Sussex
50 New Cross Hospital
51 Salisbury
52 Barking, Havering & Redbridge - Queen's
53 Barking, Havering & Redbridge - King George
54 South Tyneside and Sunderland NHS Trust
55 County Durham and Darlington
56 North Manchester General Hospital

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Which hospital do you currently work in?

- University Hospital Galway
- Mater Misericordiae University Hospital, Dublin,
- Sligo University Hospital
- Limerick regional Hospital
- Other
- Children's Health Ireland at Crumlin
- Children's Health Ireland at Temple Street
- Children's Health Ireland at Tallaght
- Bon Secours Hospital
- Cork University Hospital

Please state the name of your hospital.

What type of patients do you see in your Emergency Department?

- Adults only
- Paediatrics only
- Mixture of Adults and Paediatrics

How old are you?

- 20-25
- 26-30
- 31-35
- 36-40
- 41-45
- 46-50
- 51-55
- 56-60
- 61- 65
- 66-70
- >70

What is your gender?

- Female
- Male
- Other
- Prefer not to say

Please fill out the following "Need for Recovery Score". Please base this on the LAST MONTH of work (excluding leave).

	yes	no
I find it difficult to relax at the end of the working day?	<input type="radio"/>	<input type="radio"/>
By the end of the working day I feel really worn-out	<input type="radio"/>	<input type="radio"/>
Because of my job, at the end of the working day I feel rather exhausted	<input type="radio"/>	<input type="radio"/>
After my breaks, I feel fresh to continue my work	<input type="radio"/>	<input type="radio"/>
Generally speaking, I only start to feel relaxed on my second non-working day off	<input type="radio"/>	<input type="radio"/>
I find it difficult to concentrate in my free time after work	<input type="radio"/>	<input type="radio"/>
I find it hard to show interest in other people when I have just come home from work	<input type="radio"/>	<input type="radio"/>
In general, it takes me over an hour to feel fully recuperated after work	<input type="radio"/>	<input type="radio"/>
When I get home, I need to be left in peace for a while	<input type="radio"/>	<input type="radio"/>
Often, after a day's work I feel so tired that I cannot get involved in other activities	<input type="radio"/>	<input type="radio"/>
A feeling of tiredness prevents me from doing my work as well as I normally would during the last part of the working day	<input type="radio"/>	<input type="radio"/>

How long have you worked in your current Emergency Department?

- 1 month or less
- 1-2 months
- 2-3 months
- 3-4 months
- 4-5 months
- 5-6 months
- 6 months - 1 year
- 1-2 years
- 2-3 years
- 3-5 years
- 5 -10 years
- 10 -15 years
- 15-20 years
- > 20 years

1 How long have you worked in Emergency Medicine in total in your career?
2

- 3 1 year or less
- 4 1 year or more

5
6 How many months have you worked in Emergency Medicine in total?
7

8 _____
9
10

11
12 How many years have you worked in Emergency Medicine in total?
13

14 _____
15
16

17 What is your most frequent method of transport for your commute to work?
18

- 19 Car
- 20 Motorbike
- 21 Bus
- 22 Train
- 23 Underground
- 24 Walk
- 25 Run
- 26 Cycle
- 27 I live on-site
- 28 Other

29
30 You have selected other, how do you commute?
31

32 _____
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How long does your commute take in minutes (one way)?

	1-10 mins	11-20 mins	21-30 mins	31-40 mins	41-50 mins	51-60 mins	61-70 mins	71-80 mins	81-90 mins	>90 mins
On an average day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On a good day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
On a bad day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What type of contract do you work?

- Full time
 90%, less than full time
 80%, less than full time
 70%, less than full time
 60%, less than full time
 50%, less than full time
 less than 50%, less than full time

Do you have dedicated contracted time away from Adult Emergency Medicine (e.g. subspecialty or GP) or work in Paediatric Emergency Medicine?

- Yes
 No

Please select all that are applicable to your current contracted time.

- ICM
 PEM
 PHEM
 Academic
 Teaching
 Leadership/Management
 Paediatrics
 GP
 Other

What is your "other" contracted time?

What percentage of your contract is spent in ICM rather than EM?

- 10%
 20%
 25%
 30%
 40%
 50%
 60%
 70%
 75%
 80%
 90%
 100%

1 What percentage of your contract is spent in PEM rather than Adult EM?
2

- 3 10%
- 4 20%
- 5 25%
- 6 30%
- 7 40%
- 8 50%
- 9 60%
- 10 70%
- 11 75%
- 12 80%
- 13 90%
- 14 100%

16 What percentage of your contract is spent in PHEM rather than Adult EM?
17

- 18 10%
- 19 20%
- 20 25%
- 21 30%
- 22 40%
- 23 50%
- 24 60%
- 25 70%
- 26 75%
- 27 80%
- 28 90%
- 29 100%

31 What percentage of your contract is spent Academic rather than Adult EM?
32

- 33 10%
- 34 20%
- 35 25%
- 36 30%
- 37 40%
- 38 50%
- 39 60%
- 40 70%
- 41 75%
- 42 80%
- 43 90%
- 44 100%

45 What percentage of your contract is spent Teaching rather than Adult EM?
46

- 47 10%
- 48 20%
- 49 25%
- 50 30%
- 51 40%
- 52 50%
- 53 60%
- 54 70%
- 55 75%
- 56 80%
- 57 90%
- 58 100%
- 59
- 60

1 What percentage of your contract is spent management/leadership rather than Adult EM?
2

- 3 10%
4 20%
5 25%
6 30%
7 40%
8 50%
9 60%
10 70%
11 75%
12 80%
13 90%
14 100%

16 What percentage of your contract is spent doing paediatrics rather than EM?
17

- 18 10%
19 20%
20 25%
21 30%
22 40%
23 50%
24 60%
25 70%
26 75%
27 80%
28 90%
29 100%

31 What percentage of your contract is spent doing GP rather than Adult EM?
32

- 33 10%
34 20%
35 25%
36 30%
37 40%
38 50%
39 60%
40 70%
41 75%
42 80%
43 90%
44 100%

45 What percentage of your contract is spent doing "other" activities rather than Adult EM?
46

- 47 10%
48 20%
49 25%
50 30%
51 40%
52 50%
53 60%
54 70%
55 75%
56 80%
57 90%
58 100%
59
60

1 What is the maximum number of TOTAL clinical shifts you work in a week?
2

- 3 1 shift
- 4 2 shifts
- 5 3 shifts
- 6 4 shifts
- 7 5 shifts
- 8 6 shifts
- 9 7 shifts

11 What is the maximum number of CONSECUTIVE clinical shifts you would be scheduled to work?
12

- 13 1 shift
- 14 2 shifts
- 15 3 shifts
- 16 4 shifts
- 17 5 shifts
- 18 6 shifts
- 19 7 shifts
- 20 > 7 shifts

22 What is the maximum number of consecutive NIGHT shifts you would be scheduled to work in a row?
23

- 24 0 shifts
- 25 1 shift
- 26 2 shifts
- 27 3 shifts
- 28 4 shifts
- 29 5 shifts
- 30 6 shifts
- 31 7 shifts

33 What is the maximum number of consecutive DAY shifts you would be scheduled to work in a row?
34

- 35 0 shifts
- 36 1 shift
- 37 2 shifts
- 38 3 shifts
- 39 4 shifts
- 40 5 shifts
- 41 6 shifts
- 42 7 shifts

44 What is the maximum number of consecutive TWILIGHT shifts you would be scheduled to work in a row?
45

- 46 0 shifts
- 47 1 shift
- 48 2 shifts
- 49 3 shifts
- 50 4 shifts
- 51 5 shifts
- 52 6 shifts
- 53 7 shifts

1 What is your scheduled weekend work frequency?
2

- 3 1 in 2
4 1 in 3
5 1 in 4
6 1 in 5
7 1 in 6
8 Less frequent than 1 in 6
9 I don't work weekends

10
11 Over the past month how many contracted non-clinical shifts have you had? E.g. SPA, teaching, clinical governance.
12

- 13 0 shifts
14 Between 0-1 shifts
15 1 shift
16 2 shifts
17 3 shifts
18 4 shifts
19 5 shifts
20 6 shifts
21 7 shifts
22 8 shifts
23 9 shifts
24 10 shifts
25 11-15 shifts
26 >15 shifts

27
28 In the past month how many locum shifts have you
29 worked? _____
30

31 Over the past month, roughly how often have you left more than 15 minutes late following a clinical shift?
32

- 33 Rarely
34 A few times a month
35 Once a week
36 A few times a week
37 Everyday

38
39 Over the past month, how often have you taken your full entitlement of breaks during a clinical shift?
40

- 41 Rarely
42 A few times a month
43 Once a week
44 A few times a week
45 Everyday

46
47 What proportion would you say you spend working 'out of hours' (evenings, nights or weekends)?
48

- 49 < 25%
50 26-50%
51 51-75%
52 76-100%

53
54 What proportion of your locum shifts would you say you spend working 'out of hours' (evenings, nights or weekends)?
55

- 56 < 25%
57 26-50%
58 51-75%
59 76-100%

1 I have been able to request and take the annual leave I wanted?
2

- 3 Strongly disagree
4 Disagree
5 Neutral
6 Agree
7 Strongly agree
8

9 I have been able to request and take the study leave I wanted?
10

- 11 Strongly disagree
12 Disagree
13 Neutral
14 Agree
15 Strongly agree
16

17 Over the past month, roughly how often have you found yourself feeling overwhelmed with work during a clinical
18 shift?
19

- 20 Rarely
21 A few times a month
22 Once a week
23 A few times a week
24 Everyday
25

26 Do you consider yourself to have any long-term health conditions or disability?
27

- 28 Yes
29 No
30 Prefer not to say
31

32 Do you have significant caring responsibilities outside of work?
33 (e.g. parent or main carer for a relative)
34

- 35 Yes
36 No
37 Prefer not to say
38

39 I feel at high risk of burnout from my job in the near future?
40

- 41 Yes
42 No
43 Prefer not to say
44

45 I feel I am currently suffering burnout from work?
46

- 47 Yes
48 No
49 Prefer not to say
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TIRED Site Survey

Department Demographics

Name of emergency department and NHS trust?

Number of attendances per year?

Any specialist designation?

- Trauma unit
 Adult major trauma centre
 Stroke centre
 PCI centre
 Paediatric major trauma centre

Number of EM Consultants?

Number of EM Middle Grades (ST4 and above)?

Number of EM Middle grade career clinicians equivalent to > ST4 (eg associate specialist, specialty doctors, CESR or other non-training doctors)?

Number of EM trainees ST3?

Number of ACCS trainees ST1-2?

Number of GP trainees ST1-3?

Number of ED GPs?

Number of Clinical Fellows (Fy1-ST3)?

Number of Clinical Fellows (>=ST4)?

Number of FY2s?

Number of FY1s?

Total number of ED Doctors calculated from the answers above:

1 Out of the total number of doctors above, how many
2 will be ineligible for the study due to absence
3 during the study period? (eg maternity, sick or
4 annual leave) _____
5

6 What percentage of eligible EM doctors do you
7 estimate you will enrol in the survey? (ie if you
8 have 50 doctors and think you will enrol 25 at your
9 site, that would be 50%).

(We are aiming for a response rate of 80% of
eligible doctors as a minimum at each site but
understand this not might be achievable.
Therefore, this is an opportunity to document how
many you think will be achievable at your site.)

14 Number of advanced nurse practitioners? _____
15
16

18 Number of advanced clinical practitioners? _____
19
20

21 Number of adult qualified EM nurses? _____
22
23

24 Number of paediatric qualified EM nurses? _____
25
26

28 Number of health care assistants (or equivalent)? _____
29
30

31 Number of EM physician associates? _____
32
33

34 Does your Consultant rota use self-rostering?

- Yes
- No

38 Does your Registrar rota use self-rostering?

- Yes
- No

41 Does your SHO rota use self-rostering?

- Yes
- No

What are the current vacancy rates for permanent staff in the following roles?

	0-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91-100%
EM consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM medical staff (excluding Consultants)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM nursing staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-medical staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What percentage of patients were seen within 4 hours in April 2019?

What percentage of patients were seen within 4 hours in March 2019?

What percentage of patients were seen within 4 hours in February 2019?

What percentage of patients were seen within 4 hours in January 2019?

What percentage of patients were seen within 4 hours in December 2018?

What percentage of patients were seen within 4 hours in November 2018?

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What are the current sickness rates for the following staff groups?

	0-1%	1-2%	2-3%	3-4%	4-5%	5-6%	6-7%	7-8%	8-9%	9-10%	>10%
EM Consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Medical Staff (excluding Consultants)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Nursing staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Non-Medical Staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All Staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For peer review only

What is the Minimum Shift Length for the below groups of staff?

	6 hours	7 hours	8 hours	9 hours	10 hours	11 hours	12 hours	13 hours	N/A
EM Consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Trainees, ST4 and above	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Non-training, ST4 and above	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Trainees ST3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ACCS Trainees ST1-2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GP Trainees ST1-3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clinical Fellows (FY1- ST3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clinical Fellows (>= ST4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fy2 Doctors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fy1 Doctors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For peer review only

What is the maximum shift length for the following groups of staff

	6 hours	7 hours	8 hours	9 hours	10 hours	11 hours	12 hours	13 hours	>13 hours	N/A
EM Consultants	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Trainees, ST4 and above	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Non-trainees, ST4 and above	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EM Trainees, ST3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ACCS Trainees ST1-2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GP Trainees, ST1-3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clinical Fellows (FY1 - ST3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clinical Fellows (=>ST4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fy2 Doctors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fy1 Doctors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For peer review only

**How many hours are each of the shifts on your SHO rota?
(Select multiple if this changes depending on the shift)**

	< 8 hours	8 hours	9 hours	10 hours	11 hours	12 hours	>12 hour
Day shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Night shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Twilight shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Day shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Night shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Twilight shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

For peer review only

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How many hours are each of the shifts on your registrar rota?
(Select multiple if this changes depending on the shift)

	< 8 hours	8 hours	9 hours	10 hours	11 hours	12 hours	>12 hour
Day shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Night shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Twilight shift (week)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Day shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Night shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Twilight shift (weekend)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

For peer review only

How many hours are each of the shifts on your Consultant rota?

	< 8 hours	8 hours	9 hours	10 hours	11 hours	12 hours	>12 hour
Day shift (week)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Night shift (week)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Twilight shift (week)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Day shift (weekend)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Night shift (weekend)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Twilight shift (weekend)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Is there readily available rest facilities available for post night shifts? Yes
 No

Do people know how to access them? Yes
 No

Is there a break room available? Yes
 No

Online Supplementary Material 4
Table of Additional Participant Characteristics

Characteristic	N (%)	NFR Score	
		Median (95% CI) ¹	[LQ - UQ]
Maximum number of consecutive day shifts you would be scheduled to work			
0	30 (0.7)	63.6 (50.1 to 77.2)	[36.4 - 90.9]
1	42 (1.0)	59.1 (40.9 to 77.3)	[27.3 - 90.9]
2	217 (5.3)	63.6 (55.1 to 72.2)	[36.4 - 81.8]
3	522 (12.7)	63.6 (60.9 to 66.4)	[36.4 - 81.8]
4	788 (19.2)	63.6 (63.6 to 63.6)	[45.5 - 81.8]
5	1108 (27)	72.7 (70.0 to 75.5)	[45.5 - 81.8]
6	309 (7.5)	72.7 (66.9 to 78.6)	[54.5 - 90.9]
7	1094 (26.6)	72.7 (72.7 to 72.7)	[45.5 - 90.9]
Missing	137 (3.3)	72.7 (65.7 to 79.7)	[50.0 - 90.9]
Maximum number of consecutive Twilight shifts you would be scheduled to work			
0	339 (8.2)	54.5 (48.3 to 60.8)	[36.4 - 81.8]
1	341 (8.3)	60.0 (51.2 to 68.8)	[36.4 - 81.8]
2	496 (12.1)	54.5 (49.9 to 59.2)	[36.4 - 81.8]
3	796 (19.4)	63.6 (55.8 to 71.5)	[45.5 - 81.8]
4	1100 (26.7)	72.7 (69.9 to 75.5)	[45.5 - 90.9]
5	600 (14.6)	72.7 (72.1 to 73.4)	[54.5 - 90.9]
6	107 (2.6)	72.7 (67.6 to 77.8)	[54.5 - 90.9]
7	334 (8.1)	81.8 (74.4 to 89.3)	[54.5 - 90.9]
Missing	134 (3.3)	72.7 (67.3 to 78.1)	[54.5 - 90.9]
Maximum number of consecutive night shifts you would be scheduled to work			
0	1057 (25.6)	54.5 (52.0 to 57.1)	[27.3 - 80.0]
1	123 (3.0)	63.6 (53.2 to 74.0)	[36.4 - 90.9]
2	153 (3.7)	54.5 (44.7 to 64.4)	[45.5 - 81.8]
3	467 (11.3)	72.7 (65.6 to 79.9)	[45.5 - 90.9]
4	2188 (53.1)	72.7 (72.7 to 72.7)	[54.5 - 90.9]
5	64 (1.6)	72.7 (64.4 to 81.1)	[54.5 - 90.9]
6	6 (0.1)	54.5 (NA)	[45.5 - 81.8]
7	63 (1.5)	72.7 (64.4 to 81.1)	[54.5 - 90.9]
Missing	126 (3.1)	72.7 (67.4 to 78.0)	[54.5 - 90.9]
Maximum number of clinical shifts you work in a typical week?			
1	27 (0.7)	63.6 (45.2 to 82.0)	[45.5 - 90.9]
2	63 (1.5)	63.6 (49.2 to 78.1)	[36.4 - 81.8]

3	240 (5.9)	63.6 (58.1 to 69.2)	[36.4 - 81.8]
4	553 (13.5)	63.6 (54.9 to 72.3)	[36.4 - 81.8]
5	1074 (26.2)	63.6 (62.1 to 65.2)	[45.5 - 81.8]
6	858 (20.9)	72.7 (72.0 to 73.4)	[45.5 - 90.9]
7	1285 (31.3)	72.7 (72.7 to 72.7)	[45.5 - 90.9]
Missing	147 (3.6)	72.7 (67.1 to 78.3)	[45.5 - 90.9]
Non-clinical shifts past month			
0	1164 (28.3)	72.7 (72.7 to 72.7)	[54.5 - 90.9]
<1	394 (9.6)	72.7 (72.1 to 73.4)	[54.5 - 90.9]
1	525 (12.8)	72.7 (72.7 to 72.7)	[50.0 - 90.9]
2	527 (12.8)	63.6 (57.3 to 70.0)	[45.5 - 81.8]
3	242 (5.9)	63.6 (55.1 to 72.2)	[40.0 - 81.8]
4	525 (12.8)	60.0 (51.5 to 68.5)	[36.4 - 81.8]
5	115 (2.8)	54.5 (47.3 to 61.8)	[36.4 - 72.7]
6	124 (3.0)	54.5 (45.6 to 63.5)	[31.7 - 80.9]
7	39 (0.9)	63.6 (43.5 to 83.8)	[36.4 - 81.8]
8	157 (3.8)	54.5 (45.2 to 63.9)	[36.4 - 81.8]
9	19 (0.5)	60.0 (34.6 to 85.4)	[27.3 - 72.7]
10	102 (2.5)	54.5 (45.2 to 63.9)	[36.4 - 80.0]
11-15	86 (2.1)	54.5 (44.7 to 64.4)	[27.3 - 72.7]
>15	91 (2.2)	63.6 (47.6 to 79.7)	[27.3 - 81.8]
Missing	137 (3.3)	72.7 (66.6 to 78.9)	[54.5 - 90.9]
Average commute in minutes			
1-10	396 (9.6)	72.7 (64.2 to 81.3)	[45.5 - 81.8]
11-20	814 (19.8)	72.7 (64.6 to 80.9)	[45.5 - 90.0]
21-30	967 (23.5)	72.7 (64.6 to 80.8)	[45.5 - 90.9]
31-40	703 (17.1)	63.6 (63.6 to 63.6)	[36.4 - 81.8]
41-50	546 (13.3)	72.7 (64.5 to 81.0)	[45.5 - 90.9]
51-60	365 (8.9)	72.7 (67.6 to 77.8)	[45.5 - 90.0]
>60	325 (7.9)	72.7 (66.9 to 78.5)	[45.5 - 90.9]
Missing	131 (3.2)	72.7 (68.4 to 77.1)	[54.5 - 90.9]
Do you have a dedicated time away from adult emergency medicine?			
No	3091 (75.2)	72.7 (67.2 to 78.3)	[45.5 - 90.9]
Yes	1020 (24.8)	63.6 (62.2 to 65.1)	[36.4 - 81.8]
Missing	136 (3.3)	72.7 (67.7 to 77.8)	[45.5 - 90.9]

Frequency and percentage, median NFR score with 95% bootstrapped confidence intervals and the inter-quartile range of participants within each category.

¹ Bootstrapped 95% confidence intervals based on 1000 replications on a minimum of 8 observations.

Online Supplementary Material 5

Summary of median quantile regression model fitted to the Need for Recovery (NFR) score with fixed effects for site, including the adjusted coefficient estimate (Adj. Coef. Est.) with corresponding 95% confidence interval (CI) and p-value.

	Adj. Coeff. Est. (95% CI)	P-value¹
Constant (baseline NFR score)	59.51 (55.53 to 63.49)	< 0.001
Gender (baseline = Male)		
• Female	3.38 (1.80 to 4.95)	< 0.001
• Other/Prefer not to say	-0.10 (-7.84 to 7.64)	0.979
Any long-term health conditions or disabilities (baseline = No)		
• Yes	8.33 (5.73 to 10.93)	< 0.001
• Prefer not to say	6.10 (1.78 to 10.43)	0.006
ED paediatrics only? (baseline = No)		
• Yes	-8.47 (-12.97 to -3.98)	< 0.001
Clinical grade (baseline = Foundation)		
• ST1-ST2	-0.20 (-2.55 to 2.16)	0.869
• > ST2	1.04 (-1.49 to 3.57)	0.421
• SASG	-1.20 (-4.32 to 1.92)	0.450
• GP	-7.33 (-15.49 to 0.83)	0.078
• Consultant	-4.94 (-7.72 to -2.17)	< 0.001
I have been able to request and take study when I wanted (baseline = Neutral)		
• Strongly disagree	3.45 (-0.19 to 7.10)	0.063
• Disagree	3.57 (0.53 to 6.61)	0.022
• Agree	-1.18 (-3.36 to 1.00)	0.290
• Strongly agree	-6.32 (-9.23 to -3.41)	< 0.001
I have been able to request and take annual when I wanted (baseline = Neutral)		
• Strongly disagree	6.42 (2.69 to 10.15)	0.001
• Disagree	1.37 (-1.73 to 4.47)	0.385
• Agree	-2.60 (-5.07 to -0.13)	0.039
• Strongly agree	-4.31 (-7.33 to -1.28)	0.005
Proportion of time spent working out of hours (baseline = 0-25%)		
• 26-50%	5.96 (3.16 to 8.76)	< 0.001
• 51-75%	10.39 (7.54 to 13.25)	< 0.001
• 76-100%	14.34 (10.92 to 17.75)	< 0.001

Need for recovery amongst Emergency Physicians in the United Kingdom and Ireland: Findings from a Trainee Emergency Research Network (TERN) survey study

Research Checklist: The Checklist for Reporting Results of Internet E-Surveys (CHERRIES)

CHERRIES CHECKLIST ADAPTED FROM:			
Eysenbach, Gunther. "Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES)." <i>Journal of medical Internet research</i> vol. 6,3 e34. 29 Sep. 2004, doi:10.2196/jmir.6.3.e34			
Item Category	Checklist Item	Explanation	Checklist Response
IRB (Institutional Review Board) approval and informed consent process	Describe survey design	Describe target population, sample frame. Is the sample a convenience sample? (In "open" surveys this is most likely.)	Outlined in 'Methods'
	IRB approval	Mention whether the study has been approved by an IRB.	Outlined in 'Ethics Approval'
	Informed consent	Describe the informed consent process. Where were the participants told the length of time of the survey, which data were stored and where and for how long, who the investigator was, and the purpose of the study?	Outlined in Survey Distribution, monitoring and recruitment
	Data protection	If any personal information was collected or stored, describe what mechanisms were used to protect unauthorized access.	Outlined in Survey Distribution, monitoring and recruitment
Development and pre-testing	Development and testing	State how the survey was developed, including whether the usability and technical functionality of the electronic questionnaire had been tested before fielding the questionnaire.	Outlined in 'Survey Development'
Recruitment process and description of the sample having access to the questionnaire	Open survey versus closed survey	An "open survey" is a survey open for each visitor of a site, while a closed survey is only open to a sample which the investigator knows (password-protected survey).	Outlined in Survey Distribution, monitoring and recruitment
	Contact mode	Indicate whether or not the initial contact with the potential participants was made on the Internet. (Investigators may also send out questionnaires by mail and allow for Web-based data entry.)	Outlined in 'Survey Distribution, monitoring and recruitment'
	Advertising the survey	How/where was the survey announced or advertised? Some examples are offline media (newspapers), or online (mailing lists – If yes, which ones?) or banner ads (Where were these banner ads posted and what did they look like?). It is important to know the wording of the announcement as it will heavily influence who chooses to participate. Ideally the survey	Outlined in 'Survey Distribution, monitoring and recruitment'

		announcement should be published as an appendix.	
Survey administration	Web/E-mail	State the type of e-survey (eg, one posted on a Web site, or one sent out through e-mail). If it is an e-mail survey, were the responses entered manually into a database, or was there an automatic method for capturing responses?	Outlined in 'Survey Distribution, monitoring and recruitment'
	Context	Describe the Web site (for mailing list/newsgroup) in which the survey was posted. What is the Web site about, who is visiting it, what are visitors normally looking for? Discuss to what degree the content of the Web site could pre-select the sample or influence the results. For example, a survey about vaccination on a anti-immunization Web site will have different results from a Web survey conducted on a government Web site	Outlined in 'Design'
	Mandatory/voluntary	Was it a mandatory survey to be filled in by every visitor who wanted to enter the Web site, or was it a voluntary survey?	Outlined in 'Survey Distribution, monitoring and recruitment'
	Incentives	Were any incentives offered (eg, monetary, prizes, or non-monetary incentives such as an offer to provide the survey results)?	No
	Time/Date	In what timeframe were the data collected?	Outlined in 'Sites and settings'
	Randomization of items or questionnaires	To prevent biases items can be randomized or alternated.	Not done
	Adaptive questioning	Use adaptive questioning (certain items, or only conditionally displayed based on responses to other items) to reduce number and complexity of the questions	Outlined in Survey Distribution, monitoring and recruitment
	Number of Items	What was the number of questionnaire items per page? The number of items is an important factor for the completion rate.	Outlined in 'Design'
	Number of screens (pages)	Over how many pages was the questionnaire distributed? The number of items is an important factor for the completion rate.	Outlined in 'Design'
	Completeness check	It is technically possible to do consistency or completeness checks before the questionnaire is submitted. Was this done, and if "yes", how (usually JavaScript)? An alternative is to check for completeness after the questionnaire has been submitted (and highlight mandatory items). If this has been done, it should be reported. All items should provide a non-response option such as "not applicable" or	Not done

		“rather not say”, and selection of one response option should be enforced.	
	Review step	State whether respondents were able to review and change their answers (eg, through a Back button or a Review step which displays a summary of the responses and asks the respondents if they are correct).	<i>Outlined in Survey Distribution, monitoring and recruitment</i>
Response rates	Unique site visitor	If you provide view rates or participation rates, you need to define how you determined a unique visitor. There are different techniques available, based on IP addresses or cookies or both.	<i>Outlined in ‘Results’</i>
	View rate (Ratio of unique survey visitors/unique site visitors)	Requires counting unique visitors to the first page of the survey, divided by the number of unique site visitors (not page views!). It is not unusual to have view rates of less than 0.1 % if the survey is voluntary	<i>Survey site contains first page of survey therefore N/A</i>
	Participation rate (Ratio of unique visitors who agreed to participate/unique first survey page visitors)	Count the unique number of people who filled in the first survey page (or agreed to participate, for example by checking a checkbox), divided by visitors who visit the first page of the survey (or the informed consents page, if present). This can also be called “recruitment” rate.	<i>Outlined in ‘Results’</i>
	Completion rate (Ratio of users who finished the survey/users who agreed to participate)	The number of people submitting the last questionnaire page, divided by the number of people who agreed to participate (or submitted the first survey page). This is only relevant if there is a separate “informed consent” page or if the survey goes over several pages. This is a measure for attrition. Note that “completion” can involve leaving questionnaire items blank. This is not a measure for how completely questionnaires were filled in. (If you need a measure for this, use the word “completeness rate”.)	<i>Outlined in ‘Results’</i>
Preventing multiple entries from the same individual	Cookies used	Indicate whether cookies were used to assign a unique user identifier to each client computer. If so, mention the page on which the cookie was set and read, and how long the cookie was valid. Were duplicate entries avoided by preventing users access to the survey twice; or were duplicate database entries having the same user ID eliminated before analysis? In the latter case, which entries were kept for analysis (eg, the first entry or the most recent)?	<i>Not used</i>
	IP check	Indicate whether the IP address of the client computer was used to identify potential duplicate entries from the same user. If so, mention the period of	<i>Not used due to survey being completed on multi-user/single log-in computers</i>

		time for which no two entries from the same IP address were allowed (eg, 24 hours). Were duplicate entries avoided by preventing users with the same IP address access to the survey twice; or were duplicate database entries having the same IP address within a given period of time eliminated before analysis? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	
	Log file analysis	Indicate whether other techniques to analyze the log file for identification of multiple entries were used. If so, please describe.	Not done
	Registration	In “closed” (non-open) surveys, users need to login first and it is easier to prevent duplicate entries from the same user. Describe how this was done. For example, was the survey never displayed a second time once the user had filled it in, or was the username stored together with the survey results and later eliminated? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?	N/A
Analysis	Handling of incomplete questionnaires	Were only completed questionnaires analyzed? Were questionnaires which terminated early (where, for example, users did not go through all questionnaire pages) also analyzed?	Outlined in ‘Data Analysis’
	Questionnaires submitted with an atypical timestamp	Some investigators may measure the time people needed to fill in a questionnaire and exclude questionnaires that were submitted too soon. Specify the timeframe that was used as a cut-off point, and describe how this point was determined	N/A
	Statistical correction	Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for the non-representative sample; if so, please describe the methods.	Outlined in ‘Data Analysis’