



Have restricted working hours reduced junior doctors' experience of fatigue? A qualitative study

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6 **qualitative study**
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ABSTRACT

Objectives: To explore the effects of the UK Working Time Regulations (WTR) on trainee doctors' experience of fatigue.

Design: Qualitative research

Setting: Nine deaneries in all four nations of the UK; secondary care

Participants: Focus groups or telephone interviews were conducted with trainee doctors purposively selected from Foundation Years One and Two and specialty training in the nine deaneries. 82 junior doctors participated: 53 Foundation Programme trainees (40 in Foundation Year 1, 13 in Foundation Year 2) and 29 specialty trainees. Thirty-six participants were male and 46 were female. Specialty trainee participants were training in a wide range of medical and surgical specialties, and psychiatry.

Findings: The implementation of the WTR, whilst acknowledged to be an improvement to the earlier situation of prolonged excessive hours, has not wholly overcome experience of long working hours and fatigue. Fatigue did not just arise from hours specified in rota design. Trainees worked beyond their rostered hours for a number of reasons, including some voluntary, and other organisational, professional, cultural and contextual reasons. Fatigue was perceived to affect efficiency of skills and judgement, mood, and learning capacity.

Conclusions: The long term risks of this continued stress and fatigue, for the doctors themselves and for the effective delivery of a healthcare service, should not be ignored. Current monitoring and quality management processes may need to be reviewed to increase their sensitivity to issues regarding rotas and hours worked. Effects on fatigue and on education cannot be isolated from other contextual factors, including workforce issues. On-going attention needs to be paid to broader cultural issues, for example in relation to trainees' professional autonomy and the relationship between trainees and their seniors.

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For peer review only

ARTICLE SUMMARY

Article focus

The aim of the paper is to explore the effects of the UK Working Time Regulations (WTR) on trainee doctors' experience of fatigue.

Key messages

- The implementation of the WTR, whilst acknowledged to be an improvement to the earlier situation of prolonged excessive hours, has not wholly overcome experience of long working hours and fatigue. Current monitoring and quality management processes may need to be reviewed to increase their sensitivity to issues regarding rotas and hours worked.
- Effects on fatigue and on education cannot be isolated from other contextual factors, including workforce issues.
- On-going attention needs to be paid to broader cultural issues identified in relation to trainees' professional autonomy and the relationship between trainees and their seniors.

Strengths and limitations

- The strength of the study is the breadth of trainee participants, covering a range of training grades and specialties and all four nations of the UK.
- A potential weakness is that participants were volunteers to the study, and as such may be open to self-selection bias. However, this risk is mitigated by the instance of one group run as part of Foundation Programme teaching, where all but four of a cohort of F1s were able to attend. That group identified the same issues as the wider sample, suggesting the prevalence of the issues identified is not limited to a particularly engaged sample.

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3 **Title: Have restricted working hours reduced junior doctors' experience of fatigue? A**
4 **qualitative study**
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8 **Introduction**
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12 There is a considerable body of evidence recognising that fatigue has adverse physiological,
13 psychological and cognitive effects and can lead to deficits in performance and safety.¹

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15 Fatigue in doctors is associated with increases of risks to personal safety at work^{2,3} and
16 outside work,^{4,5} and risks to health and wellbeing.⁶⁻⁹ There is also evidence of detriments to
17 performance, for example in cognitive abilities^{10,11} and psychomotor skills,¹²⁻¹⁴ (although
18 some studies have found no performance effects^{15,16}). Fatigue has also been associated
19 directly with negative consequences for patient safety such as clinical errors and diagnostic
20 mistakes.^{4,5,17-20} This has been a concern in medicine for several years²¹ and remains so
21 today.^{22,23} The effects may be compounded by a risk that doctors do not recognise that they
22 may be subject to adverse effects.²³
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34 Several countries have introduced limits on working hours. For example, in the USA, since
35 2003, there has been national implementation of an Accreditation Council for Graduate
36 Medical Education (ACGME) 80-hour resident work week restriction, averaged over four
37 weeks; however the limit is lower in Europe. The European Working Time Directive (EWTD)
38 was introduced to limit hours, to address health and safety concerns for all workers arising
39 from long hours. Each European Union member state implemented the Directive in its own
40 legislation – the UK as the Working Time Regulations (1998). These Regulations (the WTR)
41 have applied fully to junior doctors since 2009, with a limit of 48 hours per week, averaged
42 across a reference period of 26 weeks, alongside specified minimum rest periods. The WTR
43 are implemented in rotas alongside the New Deal, which specifies a maximum of 56 hours
44 per week, with a system of banded payments.
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3 Positive effects of a reduction in working hours have been found in many studies,²⁴⁻²⁶ but not
4 all.^{27 28} The effect varies with the precise implementation of restrictions, with fatigue affected
5 by work patterns including the number of consecutive days or nights worked, the intervals
6 between shifts, and the timing of shifts (day/evening/night).²⁹⁻³¹ Short naps may ameliorate
7 the negative effects of fatigue,³² and awareness of the benefits of naps and other
8 recommendations and interventions to limit fatigue associated with rotating shift work may
9 be needed.³³

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18 Organisational cultures of long or antisocial hours³⁴ may also be a factor impacting on stress
19 and fatigue, and trainees have reported being unofficially expected to work extra hours
20 voluntarily.³⁵ Furthermore workload pressures and poor work design may increase risks of
21 negative behaviours among staff.³⁶ Limits on professional autonomy – the amount of control
22 doctors have traditionally held over their practice – may also increase doctors' stress and
23 reduce job satisfaction.³⁷⁻³⁹

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32 Consequently, simply restricting the number of work hours may be insufficient to address
33 issues relating to fatigue and its consequences. With this in mind, the question is raised
34 whether the WTR will have achieved the aim of improving junior doctors' wellbeing and
35 fatigue. To date, there has been little research looking directly at the effects of the WTR as
36 implemented and experienced in practice. This paper draws on a larger research study
37 considering perceptions of the effects of the WTR,⁴⁰ and focuses specifically on their effects
38 on trainee doctors' fatigue.

47 48 **Method**

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51 The research was reviewed by the Durham University School of Medicine, Pharmacy and
52 Health Ethics Sub-Committee, and a favourable ethical opinion received.

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56 Focus groups and telephone interviews (with participants who were unable to attend a focus
57 group) were conducted with Foundation Year One (FY1) and Foundation Year Two (FY2)

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3 trainees and specialty trainees, sampled purposively from nine deaneries in all four nations
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5 of the UK. Trainees were asked about their experience and perceptions of working hours
6
7 following the WTR. Some specialty trainees had experience of working before the
8
9 introduction of the WTR, and were asked about the change.
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12 Recruitment was undertaken following local advice; in some cases through the Deanery, in
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14 others through education centres in individual hospitals. An information sheet about the
15
16 study was distributed to trainees via email from the Deaneries or individual Trusts, and
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18 participation was on a voluntary basis. Written consent was taken at the start of focus groups
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20 and verbal consent at the start of telephone interviews, including consent for audio
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22 recording. Recordings were later transcribed.
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24 25 Analysis

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28 Data were analysed using a framework approach.⁴¹ An initial stage of familiarisation with the
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30 data and meetings between all four researchers engaged in this process enabled discussion
31
32 of the concepts and themes that emerged from the data. A thematic framework was
33
34 subsequently identified drawing upon *a priori* issues, *emergent* issues that were raised by
35
36 respondents (e.g. issues relating to work intensity), and *analytic* issues – those themes that
37
38 emerged from patterns and re-occurrences in the data (e.g. professionalism).
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41 Table 1 summarises the main a priori themes, emergent themes, and analytical themes
42
43 related to fatigue.
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45
46 Table 1. Development of themes in framework analysis
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49 A priori themes	50 Emergent themes	51 Analytic themes relevant to fatigue
52 Knowledge of WTR	53 Opinions of WTR	54 Effects of WTR implementation on fatigue
55 Shift patterns	56 Work intensity	57 Effects of fatigue
58 Rotas	59 Trainee influence on rotas	60 Drivers to working over hours
Compliance	Working beyond rostered hours	

Educational opportunities	Rostered hours and access to learning opportunities	Professionalism
Monitoring process	Commitment to patients	Culture
Personal effects	Commitment to colleagues	
	Expectations of colleagues	
	Monitoring and professionalism	
	Relationships with seniors	
	Fatigue	

Findings

Eleven focus groups and 30 telephone interviews were conducted with 82 junior doctors.

See Table 2 for details of the training grades of participants.

Table 2. Training grades of participants

Foundation Year 1 (FY1)	Foundation Year 2 (FY2)	Core or specialty training up to CT/ST3*	ST4 or higher **
40	13	7	22
Total Foundation trainees: 53		Total specialty trainees: 29	

* These are trainees in the first three years of their specialty training, and were likely to have started specialty training after the WTR introduction in 2009.

** These are in higher specialty training, in their fourth year or above.

Thirty-six participants were male and 46 were female. Specialty trainee participants were training in a wide range of medical and surgical specialties, and psychiatry.

Perceived effects of WTR on working hours

There was general agreement that working hours were much improved under the WTR, and that intended benefits in terms of reduced trainee fatigue and improved work-life balance

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3 had been achieved to some extent. Many trainees felt that the 48-hour limit was appropriate
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5 and enabled sufficient training experience, albeit with a perceived lack of flexibility.
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9 *“I think, speaking to people who didn’t have the forty-eight hour working time directive*
10 *thing, we get a lot more time to go home and enjoy ourselves and be outside the*
11 *hospital than they ever did and I think that’s a good thing, I feel like I’ve got a bit more*
12 *of a life.”* (Tel. Int. 22, Foundation)
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18 However, some participants did report still working long hours and experiencing fatigue
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20 despite the 48-hour limit and this was found to be related to a number of factors including the
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22 way in which the Regulations were implemented and other organisational and contextual
23
24 factors.
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27 **Effects of WTR implementation on fatigue**

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30 The WTR have not entirely eliminated long hours, with some trainees giving examples of
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32 working up to 100 hours in a week. However, fatigue did not necessarily arise just from the
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34 long hours worked, but also the organisation of work within those hours, for example the
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36 mixture of day and night shifts, and long shifts straddling day and night (e.g. 2.00pm to
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38 2.00am). Rotas could involve five consecutive days at work with 13-hour shifts, and working
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40 up to 12 consecutive days or, for some, seven consecutive nights (despite Royal College
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42 recommendations to the contrary). Trainees reported that averaging meant that a working
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44 week could exceed 70 hours and remain compliant.
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49 *“I don’t think the hours are long, so doing a 12 hour day or 13 hour day is fine, I think*
50 *doing 12 days in a row you hit delirium about day ten and then you over-ride it...so I*
51 *don’t think it’s the shift I think it’s the number of days you work in a row.”* (Focus
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53 group 3, Foundation)
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3 *“There’s no continuity in terms of predictability of, right this is what I’m doing and, for*
4 *example, my rota you run an eight cycle rota so you’ve got eight weeks to get*
5 *through and none of those eight weeks are the same at all, and you jump around with*
6 *longs and lates in-between and I think that from my side is what creates fatigue.”*
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11 (Focus group 10, Specialty)
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14 *“That was a particularly difficult shift on the assessment suite because you would go*
15 *from five long days with maybe two days off, or a day off sometimes, and then onto a*
16 *period of nights, you are constantly swapping from nights to days which was tiring,*
17 *and 12 hour shifts and 13 hour shifts were always a bit of a drag.”* (Tel. Int. 22,
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22 Foundation)
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26 There was also a perception that twelve-hour shifts were more fatiguing, with less ‘down-
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28 time’ than longer but less intense on-call sessions. Work intensity was also increased by
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30 rotas involving cross-cover out of hours.
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34 *“My personal opinion is [the WTR have] actually increased fatigue and stress in the*
35 *fact that you feel you have to get an increased amount of work done in a shorter*
36 *amount of time.”* (Tel. Int. 16, Foundation)
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41 Provision of facilities for taking rest during a night shift was also being reduced which,
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43 alongside less capacity to take breaks or compensatory rest, added to the fatigue
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45 experienced. Rest periods were also lost in half days – sometimes inserted into rotas to
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47 balance hours – not always being taken, sometimes because senior clinical staff were
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49 unaware of them, so workload did not respond to working hours.
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53 *“The trouble with night shift is being able to sleep during the day and most hospitals*
54 *have no facility to actually catch a nap while on nights. The last time I worked in a*
55 *hospital with bedrooms for on-call staff was in 2007 and that’s despite guidance from*
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3 *the Royal College of Physicians that it should be possible for someone to have a*
4 *short nap.” (Tel. Int. 23, Specialty)*
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9 *“The difficulty is you may be entitled to various half days but the chances of them*
10 *actually materialising are very slight...unless these things are really formalised and*
11 *recognised they just don’t happen. I mean you can just about get your half day off*
12 *before nights because everyone understands that you’re about to start nights...but*
13 *the rest of them just don’t happen.” (Tel. Int. 19, Foundation)*
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20 Fatigue did not just arise from hours specified in rota design. There were many reasons,
21 including some voluntary, for trainees working beyond their rostered hours.
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24 25 **Drivers to work long hours** 26

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29 Some reasons for working longer hours than scheduled stemmed from the capacity to fit
30 workload into the working period. This was more evident in shift work, where there was a
31 feeling that incoming doctors in the evening may not have the capacity to perform non-
32 urgent tasks, so the present doctor would finish those tasks before leaving. In contrast, in
33 on-call rotas a trainee would simply pass the bleep to the incoming doctor and so have a
34 cleaner handover.
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43 *“You kind of know yourself if I was to leave this work it’s only going to be there for me*
44 *in the morning and there’s a ward round in the morning, so I will have to get loads*
45 *more work handed my way. So you want to get things finished.” (Tel. Int. 2,*
46 *Foundation)*
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52 Other drivers came from missing educational opportunities if trainees did not attend work
53 outside the rota, including going to work on rostered days off. These opportunities included
54 attending ward rounds and observing in theatre. While benefits of the WTR for work-life
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3 balance were perceived, there was a sense that some educational activity that had been part
4 of the 'work' domain was now being taken home. This included portfolio completion and
5 reading that may have been done in the workplace during slack periods on-call.
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10 *"If you haven't got enough time to eat or go to the toilet, you can't leave work on time,*
11 *then you definitely don't have time to go to clinics, you definitely don't have time to do*
12 *audits or anything like that during work, it basically means that anything that is*
13 *exclusively for your own training is basically done in your own time and the amount of*
14 *time available to you is really diminished."* (Tel. Int. 7, Specialty)
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22 Although this increased their working hours and reduced time for rest and recuperation, the
23 benefit of taking up such opportunities was often seen to outweigh this.
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27 *"I've got no problems with the fact that I work a little bit over and take the extra time*
28 *to get training opportunities and that increases my hours to get better at my job.*
29 *That's personal sacrifice, personal advancement type stuff to get a better job to*
30 *become a consultant."* (Focus group 11, Specialty)
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37 There were also professional and cultural reasons for working beyond rostered hours. These
38 related to the expectations and norms perceived among their professional group and the
39 workplace. Trainee doctors often worked beyond rostered hours due to a sense of
40 commitment and responsibility, both to patients and to colleagues. There were cases of
41 trainees staying late to hand over the care of a patient, rather than force two handovers (for
42 example where a junior doctor would stay to complete an admission in A&E, rather than
43 hand over to another FY2 doctor, who would then have to hand over to the specialty where
44 the patient was being admitted), due to concern for continuity of care and the risk of
45 information being lost. There was also a strong sense of collegiality, expressed as a
46 responsibility not to burden colleagues with routine tasks particularly as they were likely to
47 face other immediate demands at the handover time.
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3 *“We have just never taken the half days because we’re so busy, you know; we could*
4 *have done, but would have screwed over our colleagues.”* (Focus group 2,
5 Foundation)
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10 At times, however, this could be perceived as a cultural expectation that some jobs would
11 not be left – so less a choice, more an imposition. There were references to a negative
12 culture where trainees could experience pressure from senior doctors, and other
13 professions, to stay beyond their rostered hours, with implication of unprofessionalism if they
14 left on time. There was also a perception amongst trainees that their professional reputation
15 was at risk, with implications for an employment reference and future career.
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20 Concerns about working hours were often not recognised or appreciated by seniors, with
21 some respondents identifying a dismissive attitude towards the WTR, and a feeling that such
22 limitations were counter to medical professionalism. Some trainees also agreed that limited
23 hours undermined professional autonomy, a feeling exacerbated if hours were enforced
24 during the periodic two-week monitoring process. Despite their being conscious of working
25 beyond rostered hours, few trainees kept their own record of hours worked. This was partly
26 due to their view of medicine and the nature of their work, meaning that working to limited
27 hours was not an issue to them.
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31 *“We are treated usually like we are working late due to our own failings which is not a*
32 *nice atmosphere to work in, I think it’s very important that you feel you are working,*
33 *especially as a junior in a new career, you’re working somewhere you are*
34 *appreciated, valued and not being looked at suspiciously.”* (Tel. Int. 21, Foundation)
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40 Gaps in rotas also placed additional pressure on the system, and so on individual doctors.
41 These arose from staff shortages caused by under-recruitment, as well as absences. This
42 often meant providing informal cover, for example in extended shifts. While locums were
43 used, external locums were felt to be sometimes unreliable, meaning last minute cover was
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3 often necessary. Formal internal locum shifts were sometimes used, and cross-referenced
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5 against rotas to ensure an individual did not exceed WTR hours, and there was no reported
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7 pressure to undertake locum shifts. The trainees reported that there was a shortage of
8
9 available doctors to fill rotas, even without the need to comply with the WTR. Some trainees
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11 felt that even fully staffed rotas would be stretched because the workload had increased
12
13 since the staffing levels were initially put in place.

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17 *“The fundamental issue is trying to do a decent job and you can’t do a decent job if*
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19 *there aren’t enough of you on the ground, so you are always working many hours in*
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21 *excess of what you should be doing, you end up tired and exhausted and jaded and*
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23 *then you’re not doing a good job for your patient.” (Tel. Int. 29, Foundation)*

24 25 26 **Effects of fatigue**

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29 Trainees identified effects of fatigue arising from their working hours. While detriments to
30
31 their skills and judgement were identified, these were mostly felt to affect efficiency rather
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33 than safety – however risks to patient safety cannot be discounted. Some reported that
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35 fatigue affected their ability to retain new information.

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38 *“I think when you were getting to the end of a thirteen hour shift you found that your*
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40 *technical skills, like your ability to put a cannula into someone and stuff like that, it*
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42 *certainly decreases, I find it gets a lot harder to do things that require more*
43
44 *concentration, things like that, but I think you’re also quite aware of that, so patient*
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46 *safety wise you are aware that you are not at your best so you often check more of*
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48 *your decisions with other people and things like that.” (Tel. Int. 22, Foundation)*

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51 *“I think 12 days in a stretch is too long without a day off, I just think it’s a really long*
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53 *stretch...I think [the effect] is fatigue really and I suppose you learn less towards the*
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55 *end of those days really because you are just tired.” (Tel. Int. 26, Foundation)*

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3 Fatigue was also reported to affect mood, particularly when switching between different
4 working patterns, with consequences for their professional manner. This may have
5 consequences for team-working and interprofessional communication, as well as for
6 interactions with patients.
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11 *“You become more irritable sometimes as well, I noticed I was a bit more snappy*
12 *[when switching between long days and nights] (Focus group 5, Foundation)*
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17 *“You don’t make as good decisions and you’re more grumpy, you’re less likely to be*
18 *good with the patients, you know, you’re more likely to just go in there and take the*
19 *blood rather than actually you know being a doctor to them...so you have to be a lot*
20 *more careful when you’re tired I suppose.” (Tel. Int. 9, Foundation)*
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27 These issues were sometimes compounded by hunger and discomfort arising from not
28 achieving rest breaks during long shifts.
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32 *“I think when I’m hungry my fuse is shorter and I think my compassion towards others*
33 *is not as what it should be.” (Tel. Int. 2, Foundation)*
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37 38 **Discussion**

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40 Despite the introduction of restricted working hours for junior doctors in the UK, long hours
41 and fatigue remain, with associated consequences for performance. There was general
42 agreement that restricting working hours was a positive thing, but that problems remained
43 with acute workload in some working patterns. Conversely, while most felt that a 48 hour
44 limit was appropriate, some would like more flexibility to exceed it when necessary.
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52 It was considered that the amount of work to be carried out had not reduced, increasing the
53 perceived intensity of work. Some working patterns were considered particularly intense and
54 detrimental to personal wellbeing – with consequences for performance and education. Long
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3 periods without a day off in particular were tiring. There is no objective record of hours
4 worked, as WTR compliance is derived from New Deal monitoring reports, and trainees
5 reported no formal measures for health and wellbeing.
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10 There was evidence that the design of rotas was not the only factor working against
11 wellbeing. Trainees were often working beyond their rostered hours for voluntary reasons of
12 workload, perceived need to gain educational opportunities, and collegiality, but also for
13 more external reasons such as the expectations of others and gaps in the rota. Notably
14 these are corollaries of the voluntary reasons – rota gaps increase workload, and adverse
15 cultures may define professional practice. Contrary to recent recommendations that ‘every
16 moment count’ towards education in the workplace,⁴² for some trainees at least there is
17 increasing separation between work and education, and an increase in work intensity that
18 may be adding new stresses to the trainee population.
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30 The current study provides evidence that three years after the implementation of the WTR,
31 and with rotas that are at least compliant on paper, fatigue remains an issue for doctors in
32 training. This reflects some findings in the literature that a reduction in working hours alone is
33 not enough. Although much of the literature relating to fatigue comes from the USA where
34 restricted working hours are still much longer than in Europe (e.g. >24 hour shifts until 2011,
35 or 80-hour weeks), two UK self-report studies conducted shortly after implementation of the
36 48-hour working week have highlighted the effect of different schedules on fatigue, including
37 the negative effect of working seven consecutive nights, having only one day of rest after
38 night shifts, intervals of less than ten hours between shifts, and shifts of twelve consecutive
39 days.^{30 31} Difficulty achieving naps during night shifts, and poor provision for naps, has been
40 reported elsewhere.³³ The current study has identified that fatigue is related to a number of
41 complex issues, including rota design, but also including contextual issues such as staff
42 shortages and rota gaps, and broader professional and cultural issues.
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3 Long working hours may be a symptom of, and contribute to, an adverse culture.

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5 Expectations of long hours, coupled with a lack of their explicit recognition, may be
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7 symptomatic of 'institutionalised disrespect' of workers,³⁴ which if it is felt to be normal may
8
9 lead to further dysfunctional behaviours. Culture, particularly at the level of basic underlying
10
11 assumptions that may underpin day-to-day work, can be extremely difficult to change.^{34 43}

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13 The working environment has also been found to be an important factor in encouraging and
14
15 developing professionalism,⁴⁴ and some trainees felt undermined by aspects of the
16
17 professional and organisational culture and felt there was a lack of recognition of the extra
18
19 hours they worked.

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21
22 The broader cultural issues identified in relation to trainees' professional autonomy and the
23
24 relationship between trainees and their seniors are of current relevance in light of the Francis
25
26 report's recommendations for fundamental culture change in the NHS.⁴⁵ Following these
27
28 recommendations, it has been argued that more sophisticated understandings of cultural
29
30 dynamics and the role of policy in shaping these may be needed.⁴⁶ Fatigue may be an
31
32 important mediating variable in the perpetuation of adverse cultures and practice failings,
33
34 and as such should be an important component of any policies to monitor and improve
35
36 workplace cultures.

37
38
39 Evaluation of the WTR must be considered in relation to the historical context within which
40
41 they were implemented. Perceptions of the WTR were not isolated from other changes
42
43 affecting working hours, particularly the 1991 New Deal for Junior Doctors, which imposed
44
45 restrictions for the first time. At an organisational level, changes relating to the reorganisation
46
47 of specialty training over the last 20 years⁴⁷ affected the working environment. Trainees now
48
49 have to settle on a career specialty training path sooner, meaning that the Senior House
50
51 Officer (SHO) posts they would have filled in other specialties for up to several years may
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53 remain unfilled. These gaps are compounded by the reduction in the number of overseas-
54
55 qualified doctors entering the UK following changes to immigration policy in 2008. The
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2
3 workload and hence fatigue experienced by individual trainees can therefore be seen as the
4
5 end-point of many contributory factors.
6

7 8 **Strengths and limitations**

9
10 The strength of the current study is the breadth of trainee participants, covering a range of
11
12 training grades and specialties and all four nations of the UK, so gaining a picture across the
13
14 trainee experience. A weakness is that the trainee participants were volunteers to the study,
15
16 and as such may be open to self-selection bias. However, this risk is mitigated by the
17
18 instance of one group, run as part of Foundation Programme teaching, where all but four of
19
20 a cohort of F1s were able to attend. That group identified the same issues as the wider
21
22 sample, suggesting the prevalence of the concerns identified is not limited to a particularly
23
24 engaged sample.
25
26

27 28 **Conclusion**

29
30 The WTR have reduced the hours junior doctors work, but have not fully addressed
31
32 problems of fatigue and stress, due to issues in their implementation and other contextual
33
34 factors. The long term risks of this continued stress and fatigue, for the doctors themselves
35
36 and for the effective delivery of a healthcare service, should not be ignored.
37
38

39
40 Future research could usefully involve an investigation of work intensity and its effects on
41
42 doctors' education, performance and wellbeing, and its impact on patient care. Such
43
44 research should consider the clinical demands of different specialties and the working
45
46 environment. Policy and practice could consider how best to monitor both working hours and
47
48 doctors' wellbeing. The closer and more effective involvement of trainees in rota design, with
49
50 consideration of the physiological aspects of sleep and fatigue, may help to avoid some
51
52 stresses, but there may need to be more fundamental consideration of necessary staffing
53
54 levels.
55
56

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39 **References**

- 40
41
42 1. Morrow G, Burford B, Carter M, *et al*. *The Impact of the Working Time Regulations on*
43
44 *medical education and training: Literature review*. Report to the GMC, August 2012.
45
46 [http://www.gmc-](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Literature_Review.pdf)
47
48 [uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Tr](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Literature_Review.pdf)
49
50 [aining_Literature_Review.pdf](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Literature_Review.pdf) 51155615.pdf
51
52 2. Ayas NT, Barger LK, Cade BE, *et al*. Extended work duration and the risk of self-
53
54 reported percutaneous injuries in interns. *JAMA* 2006;296:1055-62.
55
56
57
58
59
60

- 1
2
3 3. Fisman DN, Harris AD, Rubin M, *et al.* Fatigue increases the risk of injury from sharp
4 devices in medical trainees: results from a case-crossover study. *Infect Cont Hosp Ep*
5 2007;28:10-17.
6
- 7
8
9 4. Barger LK, Ayas NT, Cade BE, *et al.* Impact of extended-duration shifts on medical
10 errors, adverse events, and attentional failures. *PLOS Med* 2006;3:e487.
11
- 12
13 5. Gander P, Purnell H, Garden A, *et al.* Work patterns and fatigue-related risk among
14 junior doctors. *Occup Environ Med* 2007;64:733-738.
15
- 16
17 6. Kohen-Raz R, Himmelfarb M, Tzur S, *et al.* An initial evaluation of work fatigue and
18 circadian changes as assessed by multiplate posturography. *Percept Motor Skill*
19 1996;82:547-557.
20
- 21
22 7. Parshuram CS, Dhanani S, Kirsh JA, *et al.* Fellowship training, workload, fatigue and
23 physical stress: A prospective observational study. *Can Med Assoc J* 2004;170:965-970.
24
- 25
26 8. Smith AM, Morris P, Rowell KO, *et al.* Junior doctors and the full shift rota - psychological
27 and hormonal changes: a comparative cross-sectional study. *Clin Med* 2006;6:174-177.
28
- 29
30 9. Block L, Wu AW, Feldman L, *et al.* Residency schedule, burnout and patient care among
31 first-year residents. *Postgrad Med J* 2013;89:495-500.
32
- 33
34 10. Gohar A, Adams A, Gertner E, *et al.* Working memory capacity is decreased in sleep-
35 deprived internal medicine residents. *J Clin Sleep Med* 2009;5:191-197.
36
- 37
38 11. Lockley SW, Cronin JW, Evans EE, *et al.* Effect of reducing interns' weekly work hours
39 on sleep and attentional failures. *New Engl J Med* 2004;351:1829-1837.
40
- 41
42 12. Jakubowicz DM, Price EM, Glassman HJ, *et al.* Effects of a twenty-four hour call period
43 on resident performance during simulated endoscopic sinus surgery in an Accreditation
44 Council for Graduate Medical Education-compliant training program. *Laryngoscope*
45 2005;115:143-146.
46
- 47
48 13. Gander P, Millar M, Webster C, *et al.* Sleep loss and performance of anaesthesia
49 trainees and specialists. *Chronobiol Int* 2008; 25:1077-1091.
50
- 51
52 14. Brandenberger J, Kahol K, Feinstein AJ, *et al.* Effects of duty hours and time of day on
53 surgery resident proficiency. *Am J Surg* 2010;200:814-818.
54
55
56
57
58
59
60

- 1
2
3 15. Ellman PI, Law MG, Tache-Leon C, *et al.* Sleep deprivation does not affect operative
4 results in cardiac surgery. *Ann Thorac Surg* 2004;78:906-911.
- 5
6
7 16. Lehmann KS, Martus P, Little-Elk S, *et al.* Impact of sleep deprivation on medium-term
8 psychomotor and cognitive performance of surgeons: prospective cross-over study with
9 a virtual surgery simulator and psychometric tests. *Surgery* 2010;147:246-254.
- 10
11
12 17. Grantcharov TP, Bardram L, Funch-Jensen P, *et al.* Laparoscopic performance after one
13 night on call in a surgical department: prospective study. *Brit Med J* 2001;323:1222-3.
- 14
15
16 18. Landrigan CP, Rothschild JM, Cronin JW, *et al.* Effects of reducing interns' work hours
17 on serious medical errors in intensive care units. *New Engl J Med* 2004;351:1838-1848.
- 18
19
20 19. Lockley SW, Landrigan CP, Barger LK, *et al.* Harvard Work Hours, Health Safety Group.
21 When policy meets physiology: the challenge of reducing resident work hours. *Clin*
22 *Orthop Relat R* 2006;449:16-127.
- 23
24
25 20. Majekodunmi A, Landrigan CP. The effect of physician sleep deprivation on patient
26 safety in perinatal-neonatal medicine. *Am J Perinat* 2012;29:43-48.
- 27
28
29 21. Vorona RD, Chen IA, Ware JC. Physicians and sleep deprivation. *Sleep Medicine Clinics*
30 2009;4:527-540.
- 31
32
33 22. Paice E, Hamilton-Fairley D. Avoiding burnout in new doctors: sleep, supervision and
34 teams. *Postgrad Med J* 2013;89:493.
- 35
36
37 23. Sokol DK. Waking up to the effects of fatigue in doctors. *Brit Med J* 2013;347:f4906
- 38
39
40 24. Conigliaro J, Frishman WH, Lazar EJ, *et al.* Internal medicine housestaff and attending
41 physician perceptions of the impact of the New York State Section 405 regulations on
42 working conditions and supervision of residents in two training programs. *J Gen Intern*
43 *Med* 1993; 8:502-507.
- 44
45
46 25. Kort KC, Pavone LA, Jensen E, *et al.* Resident perceptions of the impact of work-hour
47 restrictions on health care delivery and surgical education: time for transformational
48 change. *Surgery* 2004;136:861-871.
- 49
50
51
52
53
54
55
56
57
58
59
60

- 1
2
3 26. Kiernan M, Civetta J, Bartus C, *et al.* 24 hours on-call and acute fatigue no longer
4 worsen resident mood under the 80-hour work week regulations. *Curr Surg* 2006;63:237-
5 241.
6
7
8
9 27. Cull WL, Mulvey HJ, Jewett EA, *et al.* Pediatric residency duty hours before and after
10 limitations. *Pediatrics* 2006;118:e1805-1811.
11
12
13 28. Reddy R, Guntupalli K, Alapat P, *et al.* Sleepiness in medical ICU residents. *Chest*
14 2009;135:81-85.
15
16
17 29. Berios I, Surani S, Simmons M. Assessing reaction time among emergency medicine
18 residents working different shift hours. *Ann Emerg Med* 2009; 54: S35.
19
20
21 30. Brown M, Tucker P, Rapport F, *et al.* The impact of shift patterns on junior doctors'
22 perceptions of fatigue, training, work/life balance and the role of social support. *Qual Saf*
23 *Health Care* 2010;19:e36.
24
25
26
27 31. Tucker P, Brown M, Dahlgren A, *et al.* The impact of junior doctors' worktime
28 arrangements on their fatigue and well-being. *Scand J Work Env Hea* 2010;36:458-46
29
30
31 32. Arora V, Dunphy C, Chang VY, *et al.* The effects of on-duty napping on intern sleep time
32 and fatigue. *Ann Intern Med* 2006;144:792-798.
33
34
35
36 33. Jackson EJ, Moreton A. Safety during night shifts: a cross-sectional survey of junior
37 doctors' preparation and practice. *BMJ Open* 2013 3: doi: 10.1136/bmjopen-2013-
38 003567.
39
40
41 34. Leape LL, Shore MF, Dienstag JL, *et al.* A culture of disrespect, Part 1: The nature and
42 causes of disrespectful behavior by physicians. *Acad Med* 2012;87:845-852.
43
44
45 35. O'Gallagher MK, Lewis G, Mercieca K, *et al.* The impact of the European Working Time
46 Regulations on Ophthalmic Specialist Training - A national trainee survey. *Int J Surg*
47 2013: <http://dx.doi.org/10.1016/j.ijsu.2013.08.007>
48
49
50
51
52 36. Illing JC, Carter M, Thompson NJ, *et al.* *Evidence synthesis on the occurrence, causes,*
53 *consequences, prevention and management of bullying and harassing behaviours to*
54 *inform decision making in the NHS. Final report.* NIHR Service Delivery and Organisation
55 programme; 2013.
56
57
58
59
60

- 1
2
3 37. Williams ES, Konrad TR, Scheckler WE, *et al.* Understanding physicians' intentions to
4 withdraw from practice: the role of job satisfaction, job stress, mental and physical
5 health. *AHCM* 2001;2:243-262.
6
7
8
9 38. Edwards N, Kornacki MJ, Silversin J. Unhappy doctors: what are the causes and what
10 can be done? *Brit Med J* 2002;324:835-8.
11
12
13 39. Visser MRM, Smets EMA, Oort FJ, *et al.* Stress, satisfaction and burnout among Dutch
14 medical specialists. *CMAJ* 2003;168:271-5.
15
16
17 40. Morrow G, Burford B, Carter M, *et al.* *The Impact of the Working Time Regulations on*
18 *medical education and training: Final report on primary research.* Report to the GMC,
19 August 2012. [http://www.gmc-](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf_51157039.pdf)
20 [uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Tr](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf_51157039.pdf)
21 [aining_Final_Report_on_Primary_Research.pdf_51157039.pdf](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf_51157039.pdf)
22
23
24
25
26
27 41. Ritchie J, Spencer L. Qualitative data analysis for applied policy research. In: Bryman A,
28 Burgess RG, editors. *Analysing Qualitative Data.* London: Routledge; 1994. p.173-194.
29
30
31 42. Temple J. Time for Training: A review of the impact of the European Working Time
32 Directive on the quality of training. 2010.
33
34
35 http://www.mee.nhs.uk/pdf/JCEWTD_Final%20report.pdf
36
37
38 43. Schein EH. *Organisational culture and leadership.* 4th edn. Jossey-Bass, 2010.
39
40 44. Morrow G, Burford B, Rothwell C, Carter M, McLachlan J, Illing J. *Professionalism in*
41 *healthcare professionals. Perceptions of professionalism.* Final report to the hpc, 2011.
42
43 [http://www.hpc-](http://www.hpc-uk.org/assets/documents/10003771Professionalisminhealthcareprofessionals.pdf)
44 [uk.org/assets/documents/10003771Professionalisminhealthcareprofessionals.pdf](http://www.hpc-uk.org/assets/documents/10003771Professionalisminhealthcareprofessionals.pdf)
45
46
47 45. Francis R. *Report of the Mid Staffordshire NHS Foundation Trust public inquiry.*
48 Stationery Office, 2013.
49
50
51 46. Davies H, Mannion R. Will prescriptions for cultural change improve the NHS? *Brit Med J*
52 2013;346:f1305.
53
54
55 47. HMSO. *Hospital Doctors: Training for the future.* The report of the working group on
56 specialist medical training. HMSO, 1993.
57
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Have restricted working hours reduced junior doctors' experience of fatigue? A focus group and telephone interview study

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Manuscripts

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4 **Have restricted working hours reduced junior doctors' experience of fatigue? A**
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6 **qualitative focus group and telephone interview study**
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ABSTRACT

Objectives: To explore the effects of the UK Working Time Regulations (WTR) on trainee doctors' experience of fatigue.

Design: Qualitative research

Setting: Nine deaneries in all four UK nations of the UK; secondary care

Participants: Focus groups or telephone interviews were conducted with trainee doctors purposively selected from Foundation Years One and Two and specialty training in the nine deaneries. 82 Eighty-two junior doctors participated: 53 Foundation Programme trainees (40 in Foundation Year 1, 13 in Foundation Year 2) and 29 specialty trainees. Thirty-six participants were male, and 46 were female. Specialty trainee participants were training in from a wide range of medical and surgical specialties, and psychiatry.

Findings: The implementation of the WTR, whilst acknowledged to be an improvement to the earlier situation of prolonged excessive hours, has not wholly overcome experience of long working hours and fatigue. Fatigue did not just arise from scheduled hours specified in rota design, but also from an unpredictable mixture of shifts, work intensity, which often resulted in educational tasks being taken home, and inadequate rest. It was also caused by tTrainees worked beyond their rota, for rostered hours. reasons including completing tasks, accessing educational opportunities outside scheduled hours and staffing issues. including some voluntary, and other There were also organisational, professional and cultural and contextual reasons factors, such as a sense of responsibility to patients and colleagues and the expectations of seniors. Fatigue was perceived to affect efficiency of skills and judgement, mood, and learning capacity.

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3 **Conclusions:** The long term risks of this continued stress and fatigue, for the doctors
4 themselves and for the effective delivery of a healthcare service, should not be ignored.
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6 Current monitoring and quality management processes may need to be reviewed to increase
7
8 their sensitivity to issues regarding rotas and arising from hours worked. Effects on fatigue
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10 and on education cannot be isolated from other contextual factors, including workforce
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12 issues numbers. On-going attention needs to be paid to broader cultural issues, including for
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14 example in relation to trainees' professional autonomy and the relationship between trainees
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16 and their seniors.
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ARTICLE SUMMARY

Article focus

The aim of the paper is to explore the effects of the UK Working Time Regulations (WTR) on trainee doctors' experience of fatigue.

Key messages

- The implementation of the WTR, whilst acknowledged to be an improvement to the earlier situation of prolonged excessive hours, has not wholly overcome experience of long working hours and fatigue. Reasons for persistent fatigue include the organisation of working patterns, work compression and intensity - thus also taking more work home – and working longer than rostered hours. This was related to taking up extra educational opportunities at work and to professional and organisational culture, including trainees' sense of responsibility towards patients and colleagues and the expectations of seniors. Current monitoring and quality management processes may need to be reviewed to increase their sensitivity to issues regarding rotas and hours worked. Current monitoring processes lack sensitivity to issues regarding rotas and hours worked.
- Effects on fatigue and on education cannot be isolated from other contextual factors, including workforce issues.
- On-going attention needs to be paid to broader cultural issues identified in relation to trainees' professional autonomy and expectations placed on trainees and the relationship between trainees and their seniors.

Strengths and limitations

- The strength of the study is the breadth of trainee participants, covering a range of training grades and specialties and all four nations of the UK.
- A potential weakness is that participants were volunteers to the study, and as such may be open to self-selection bias. However, this risk is mitigated by the instance of

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3 one group run as part of Foundation Programme teaching, where all but four of a
4 cohort of Foundation Year One trainees (F1s) were able to attend. That group
5 identified the same issues as the wider sample, suggesting the prevalence of the
6 issues identified is not limited to a particularly engaged sample. There may also be
7 potential inaccuracies in individual recall of hours worked.
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3 **Title: Have restricted working hours reduced junior doctors' experience of fatigue? A**
4 **qualitative focus group and telephone interview study**
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8 **Introduction**
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12 There is a considerable body of evidence recognising that fatigue has adverse physiological,
13 psychological and cognitive effects and can lead to deficits in performance and safety.¹

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15 Fatigue in doctors is associated with increases of risks to personal safety at work^{2 3} and
16 outside work,^{4 5} and risks to health and well-being.⁶⁻⁹ There is also evidence of detriments to
17 performance, for example in cognitive abilities^{10 11} and psychomotor skills,¹²⁻¹⁴ (although
18 some studies have found no performance effects^{15 16}). Fatigue has also been associated
19 directly with negative consequences for patient safety such as clinical errors and diagnostic
20 mistakes.^{4 5 17-20} This has been a concern in medicine for several years²¹ and remains so
21 today.^{22 23} The effects may be compounded by a risk that doctors do not recognise that they
22 may be subject to adverse effects.²³
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34 Several countries have introduced limits on working hours. For example, in the USA, since
35 2003, there has been national implementation of an Accreditation Council for Graduate
36 Medical Education (ACGME) 80-hour resident work week restriction, averaged over four
37 weeks; however the limit is lower in Europe. The European Working Time Directive (EWTD)
38 was introduced to limit hours, to address health and safety concerns for all workers arising
39 from long hours. Each European Union member state implemented the Directive in its own
40 legislation – the UK as the Working Time Regulations (1998). These Regulations (the WTR)
41 have applied fully to junior doctors since 2009, with a limit of 48 hours per week, averaged
42 across a reference period of 26 weeks, alongside specified minimum rest periods. The WTR
43 are implemented in rotas (work schedules) alongside the New Deal, which specifies a
44 maximum of 56 hours per week, with a system of banded payments.
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3 Positive effects of a reduction in working hours have been found in many studies,²⁴⁻²⁶ but not
4 all.^{27 28} The effect varies with the precise implementation of restrictions, with fatigue affected
5 by work patterns including the number of consecutive days or nights worked, the intervals
6 between shifts, and the timing of shifts (day/evening/night).²⁹⁻³¹ Short naps may ameliorate
7 the negative effects of fatigue,³² and awareness of the benefits of naps and other
8 recommendations and interventions to limit fatigue associated with rotating shift work may
9 be needed.³³

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18 Organisational cultures of long or antisocial hours³⁴ may also be a factor impacting on stress
19 and fatigue, and trainees have reported being unofficially expected to work extra hours
20 voluntarily.³⁵ Furthermore workload pressures and poor work design may increase risks of
21 negative behaviours among staff.³⁶ Limits on professional autonomy – the amount of control
22 doctors have traditionally held over their practice – may also increase doctors' stress and
23 reduce job satisfaction.³⁷⁻³⁹

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32 Consequently, simply restricting the number of work hours may be insufficient to address
33 issues relating to fatigue and its consequences. With this in mind, the question is raised
34 whether the WTR will have achieved the aim of improving junior doctors' well-being and
35 fatigue. To date, there has been little research looking directly at the effects of the WTR as
36 implemented and experienced in practice. This paper draws on a larger research study
37 considering perceptions of the effects of the WTR,⁴⁰ and focuses specifically on their effects
38 on trainee doctors' fatigue.

47 48 **Method**

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51 The research was reviewed by the Durham University School of Medicine, Pharmacy and
52 Health Ethics Sub-Committee, and a favourable ethical opinion received.

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56 Focus groups and telephone interviews (with participants who were unable to attend a focus
57 group) were conducted with Foundation Year One (FY1) and Foundation Year Two (FY2)

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3 trainees and specialty trainees, sampled purposively from nine deaneries in all four nations
4 of the UK. The Foundation Programme is a two-year generic training programme undertaken
5 after completing medical school, and is followed by specialist or general practice training.
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7 The WTR apply to all years of training in the same way. Trainees were asked about their
8 experience and perceptions of working hours following the WTR.
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14 The focus group topic guide and interview questions focused on perceptions and experience
15 of working hours following the WTR and any educational or personal impact. Trainees were
16 asked about their knowledge of the WTR; their perceptions of their working hours in practice,
17 including shifts, rotas and compliance; issues concerning educational opportunities;
18 monitoring of working hours, and any personal effects they experienced. Some specialty
19 trainees had experience of working before the introduction of the WTR, and were asked
20 about the change.
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29 Recruitment was undertaken following local advice; in some cases through the Deanery, in
30 others through education centres in individual hospitals. An information sheet about the
31 study was distributed to trainees via email from the Deaneries or individual Trusts, and
32 participation was on a voluntary basis. Written consent was taken at the start of focus groups
33 and verbal consent at the start of telephone interviews, including consent for audio
34 recording. Recordings were later transcribed. GM and BB conducted the focus groups and
35 telephone interviews. Focus groups lasted between 60 and 90 minutes, and telephone
36 interviews between 30 and 45 minutes.
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46 **Analysis**

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49 Data were analysed using a framework approach.⁴¹ An initial stage of familiarisation, with the
50 data, to gain an overall view of the data, involved reading the transcripts and noting the
51 range and depth in the data collected. Meetings between all four researchers engaged in this
52 process (GM, BB, MC, JI) enabled discussion of the concepts and themes that emerged
53 from the data. A thematic framework was subsequently identified by GM and BB. This
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involved identifying the key issues, concepts or themes by which the data could be examined and sorted. The construction of the framework drew upon:

- *a priori* issues - those issues that were known or assumed to be pertinent, that guided the study aims and were developed into the topic guide/interview schedule;
- *emergent* issues - those issues that were raised by the respondents (e.g. issues relating to work intensity);
- *analytic* issues - those themes that emerged from patterns and re-occurrences in the data (e.g. professionalism)

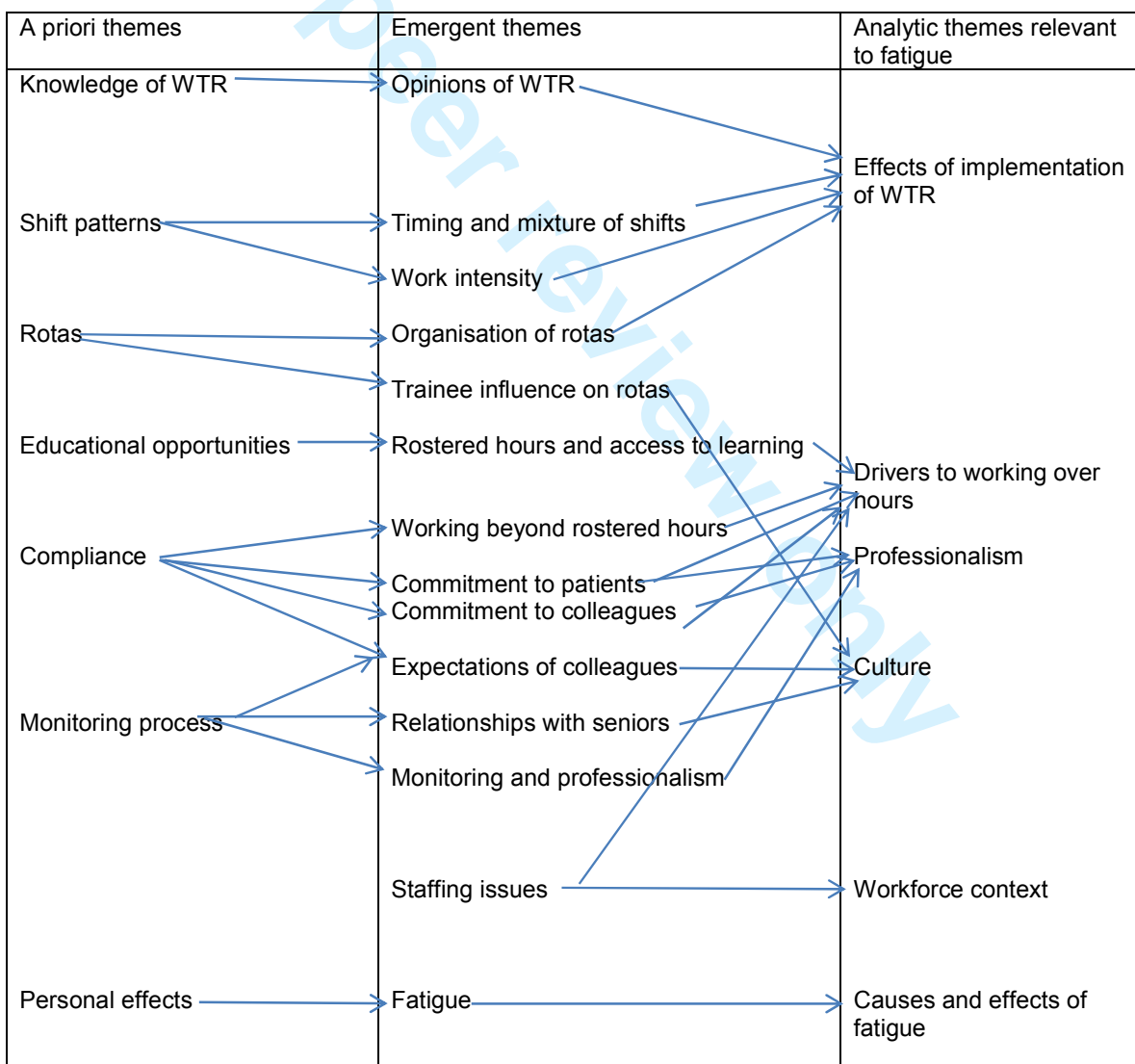
The framework was then applied to the data by GM and BB through indexing and charting, and themes and sub-themes were further refined. Finally, a stage of mapping and interpretation involved bringing the key themes within the data set together and pulling together the findings of the analysis as a whole. Table 1 summarises the main *a priori* themes, emergent themes, and analytic themes related to fatigue and illustrates the mapping and interpretation of the themes. The process of analysis helped provide an explanation of why fatigue remains an issue, and of the inter-relatedness of the issues identified.

drawing upon *a priori* issues, *emergent* issues that were raised by respondents (e.g. issues relating to work intensity), and *analytic* issues. – those themes that emerged from patterns and re-occurrences in the data (e.g. professionalism). Data from focus groups and telephone interviews were analysed concurrently and no differences in themes were identified.

Table 1. Development of themes in framework analysis

A priori themes	Emergent themes	Analytic themes relevant to fatigue
Knowledge of WTR	Opinions of WTR	Effects of WTR implementation on fatigue
Shift patterns	Work intensity	Effects of fatigue
Rotas	Trainee influence on rotas	Drivers to working
Compliance	Working beyond rostered hours	

Educational opportunities	Rostered hours and access to learning opportunities	over hours
Monitoring process	Commitment to patients	Professionalism
Personal effects	Commitment to colleagues	Culture
	Expectations of colleagues	
	Monitoring and professionalism	
	Relationships with seniors	
	Fatigue	



Findings

Eleven focus groups and 30 telephone interviews were conducted with 82 junior doctors.

See Table 2 for details of the training grades of participants.

Table 2. Training grades of participants

Foundation Year 1 (FY1)	Foundation Year 2 (FY2)	Core or specialty training up to CT/ST3*	ST4 or higher **
40	13	7	22
Total Foundation trainees: 53		Total specialty trainees: 29	

* These are trainees in the first three years of their specialty training, and were likely to have started specialty training after the WTR introduction in 2009.

** These are in higher specialty training, in their fourth year or above.

Thirty-six participants were male and 46 were female. Specialty trainee participants were training in a wide range of medical and surgical specialties, and psychiatry.

Perceived effects of WTR on working hours

There was general agreement that working hours were much improved under the WTR, and that intended benefits in terms of reduced trainee fatigue and improved work-life balance had been achieved to some extent. Many trainees felt that the 48-hour limit was appropriate and enabled sufficient training experience, albeit with a perceived lack of flexibility.

"I think, speaking to people who didn't have the forty-eight hour working time directive thing, we get a lot more time to go home and enjoy ourselves and be outside the hospital than they ever did and I think that's a good thing, I feel like I've got a bit more of a life." (Tel. Int. 22, Foundation)

However, some participants did report still working long hours and experiencing fatigue despite the 48-hour limit and this was found to be related to a number of factors including the

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3 way in which the Regulations were implemented and other organisational and contextual
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5 factors.

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8 **Effects of WTR implementation on fatigue** Implementation of WTR in practice: effects on
9 fatigue

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11 However, some participants did report still working long hours and experiencing fatigue
12 despite the 48-hour limit and this was found to be related to a number of factors including the
13 way in which the Regulations were implemented and other organisational and contextual
14 factors.
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19
20 The WTR have not entirely eliminated long hours, with some trainees giving examples of
21 working up to 100 hours in a week. However, fatigue did not necessarily arise just from the
22 long hours worked, but also the organisation of work within those hours, for example the
23 mixture of day and night shifts, and long shifts straddling day and night (e.g. 2.00pm to
24 2.00am). Rotas could involve five consecutive days at work with 13-hour shifts, and working
25 up to 12 consecutive days or, for some, seven consecutive nights (despite Royal College
26 recommendations to the contrary). Trainees reported that averaging meant that a working
27 week could exceed 70 hours and remain compliant.
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37
38 *"I don't think the hours are long, so doing a 12 hour day or 13 hour day is fine, I think*
39 *doing 12 days in a row you hit delirium about day ten and then you over-ride it...so I*
40 *don't think it's the shift I think it's the number of days you work in a row."* (Focus
41 group 3, Foundation)
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44

45
46
47 *"There's no continuity in terms of predictability of, right this is what I'm doing and, for*
48 *example, my rota you run an eight cycle rota so you've got eight weeks to get*
49 *through and none of those eight weeks are the same at all, and you jump around with*
50 *longs and lates in-between and I think that from my side is what creates fatigue."*
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54
55 (Focus group 10, Specialty)
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3 *“That was a particularly difficult shift on the assessment suite because you would go*
4 *from five long days with maybe two days off, or a day off sometimes, and then onto a*
5 *period of nights, you are constantly swapping from nights to days which was tiring,*
6 *and 12 hour shifts and 13 hour shifts were always a bit of a drag.”* (Tel. Int. 22,
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9
10
11 Foundation)

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13
14 There was also a perception that twelve-hour shifts were more fatiguing, with less ‘down-
15 time’ than longer but less intense on-call sessions. Work intensity was also increased by
16 rotas involving cross-cover out of hours.
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19

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21
22 *“My personal opinion is [the WTR have] actually increased fatigue and stress in the*
23 *fact that you feel you have to get an increased amount of work done in a shorter*
24 *amount of time.”* (Tel. Int. 16, Foundation)
25
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29
30 Provision of facilities for taking rest during a night shift was also being reduced which,
31 alongside less capacity to take breaks or compensatory rest, added to the fatigue
32 experienced. Rest periods were also lost in half days – sometimes inserted into rotas to
33 balance hours – not always being taken, sometimes because senior clinical staff were
34 unaware of them, so workload did not respond to working hours.
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41 *“The trouble with night shift is being able to sleep during the day and most hospitals*
42 *have no facility to actually catch a nap while on nights. The last time I worked in a*
43 *hospital with bedrooms for on-call staff was in 2007 and that’s despite guidance from*
44 *the Royal College of Physicians that it should be possible for someone to have a*
45 *short nap.”* (Tel. Int. 23, Specialty)
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52
53 *“The difficulty is you may be entitled to various half days but the chances of them*
54 *actually materialising are very slight...unless these things are really formalised and*
55 *recognised they just don’t happen. I mean you can just about get your half day off*
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3 *before nights because everyone understands that you're about to start nights...but*
4 *the rest of them just don't happen."* (Tel. Int. 19, Foundation)
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9 Fatigue did not just arise from hours specified in rota design. There were many reasons,
10 including some voluntary, for trainees working beyond their rostered hours.
11

12 13 14 **Drivers to work long hours**

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17 Fatigue did not just arise from hours specified in rota design. There were many reasons,
18 including some voluntary, for trainees working beyond their rostered (scheduled) hours.
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23 Some reasons for working longer hours than scheduled stemmed from the capacity to fit
24 workload into the working period. This was more evident in shift work, where there was a
25 feeling that incoming doctors in the evening may not have the capacity to perform non-
26 urgent tasks, so the present doctor would finish those tasks before leaving. In contrast, in
27 on-call rotas a trainee would simply pass the bleep to the incoming doctor and so have a
28 cleaner handover.
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37 *"You kind of know yourself if I was to leave this work it's only going to be there for me*
38 *in the morning and there's a ward round in the morning, so I will have to get loads*
39 *more work handed my way. So you want to get things finished."* (Tel. Int. 2,
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41
42
43 Foundation)
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45

46
47 Other drivers came from missing educational opportunities if trainees did not attend work
48 outside the rota, including going to work on rostered days off. These opportunities included
49 attending ward rounds and observing in theatre. While benefits of the WTR for work-life
50 balance were perceived, there was a sense that some educational activity that had been part
51 of the 'work' domain was now being taken home. This included portfolio completion and
52 reading that may have been done in the workplace during slack periods on-call.
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3 *“If you haven’t got enough time to eat or go to the toilet, you can’t leave work on time,*
4 *then you definitely don’t have time to go to clinics, you definitely don’t have time to do*
5 *audits or anything like that during work, it basically means that anything that is*
6 *exclusively for your own training is basically done in your own time and the amount of*
7 *time available to you is really diminished.” (Tel. Int. 7, Specialty)*
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14 Although this increased their working hours and reduced time for rest and recuperation, the
15 benefit of taking up such opportunities was often seen to outweigh this.
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19
20 *“I’ve got no problems with the fact that I work a little bit over and take the extra time*
21 *to get training opportunities and that increases my hours to get better at my job.*
22 *That’s personal sacrifice, personal advancement type stuff to get a better job to*
23 *become a consultant.” (Focus group 11, Specialty)*
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29
30 There were also professional and cultural reasons for working beyond rostered hours. These
31 related to the expectations and norms perceived among their professional group and the
32 workplace. Trainee doctors often worked beyond rostered hours due to a sense of
33 commitment and responsibility, both to patients and to colleagues. There were cases of
34 trainees staying late to hand over the care of a patient, rather than force two handovers (for
35 example where a junior doctor would stay to complete an admission in A&E, rather than
36 hand over to another FY2 doctor, who would then have to hand over to the specialty where
37 the patient was being admitted), due to concern for continuity of care and the risk of
38 information being lost. There was also a strong sense of collegiality, expressed as a
39 responsibility not to burden colleagues with routine tasks particularly as they were likely to
40 face other immediate demands at the handover time.
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53 *“We have just never taken the half days because we’re so busy, you know; we could*
54 *have done, but would have screwed over our colleagues.” (Focus group 2,*
55 *Foundation)*
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3 At times, however, this could be perceived as a cultural expectation that some jobs would
4 not be left – so less a choice, more an imposition. There were references to a negative
5 culture where trainees could experience pressure from senior doctors, and other
6 professions, to stay beyond their rostered hours, with implication of unprofessionalism if they
7 left on time. There was also a perception amongst trainees that their professional reputation
8 was at risk, with implications for an employment reference and future career.
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16 Concerns about working hours were often not recognised or appreciated by seniors, with
17 some respondents identifying a dismissive attitude towards the WTR, and a feeling that such
18 limitations were counter to medical professionalism. Some trainees also agreed that limited
19 hours undermined professional autonomy, a feeling exacerbated if hours were enforced
20 during the periodic two-week monitoring process.
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28 *“If you clicked that you started at 8.00 and you were meant to start at 9.00, you had*
29 *to explain...why did you do it, so quite a lot of the time I wouldn't put down that I*
30 *started before 9.00 because I knew I was going to have to justify that I came in*
31 *before 9.00.”* (Focus group 5, Foundation)
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38 Trainees reported that, as WTR compliance is derived from these New Deal monitoring
39 reports, there was no objective record of hours worked, and there were also no formal
40 measures for health and well-being. However, few trainees kept their own record of hours
41 worked. Despite their being conscious of working beyond rostered hours., few trainees kept
42 their own record of hours worked. This was partly due to their view of medicine and the
43 nature of their work, meaning that working to limited hours was not an issue to them.
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51 *“We are treated usually like we are working late due to our own failings which is not a*
52 *nice atmosphere to work in, I think it's very important that you feel you are working,*
53 *especially as a junior in a new career, you're working somewhere you are*
54 *appreciated, valued and not being looked at suspiciously.”* (Tel. Int. 21, Foundation)
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3 Gaps in rotas also placed additional pressure on the system, and so on individual doctors.
4
5 These arose from staff shortages caused by under-recruitment, as well as absences. This
6
7 often meant providing informal cover, for example in extended shifts. While locums were
8
9 used, external locums were felt to be sometimes unreliable, meaning last minute cover was
10
11 often necessary. Formal internal locum shifts were sometimes used, and cross-referenced
12
13 against rotas to ensure an individual did not exceed WTR hours, and there was no reported
14
15 pressure to undertake locum shifts. The trainees reported that there was a shortage of
16
17 available doctors to fill rotas, even without the need to comply with the WTR. Some trainees
18
19 felt that even fully staffed rotas would be stretched because the workload had increased
20
21 since the staffing levels were initially put in place.
22
23

24
25 *“The fundamental issue is trying to do a decent job and you can’t do a decent job if*
26
27 *there aren’t enough of you on the ground, so you are always working many hours in*
28
29 *excess of what you should be doing, you end up tired and exhausted and jaded and*
30
31 *then you’re not doing a good job for your patient.”* (Tel. Int. 29, Foundation)
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34 **Effects of fatigue**

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37 Trainees identified effects of fatigue arising from their working hours. While detriments to
38
39 their skills and judgement were identified, these were mostly felt to affect efficiency rather
40
41 than safety – however risks to patient safety cannot be discounted. Some reported that
42
43 fatigue affected their ability to retain new information.
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46
47 *“I think when you were getting to the end of a thirteen hour shift you found that your*
48
49 *technical skills, like your ability to put a cannula into someone and stuff like that, it*
50
51 *certainly decreases, I find it gets a lot harder to do things that require more*
52
53 *concentration, things like that, but I think you’re also quite aware of that, so patient*
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55 *safety wise you are aware that you are not at your best so you often check more of*
56
57 *your decisions with other people and things like that.”* (Tel. Int. 22, Foundation)
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3 *"I think 12 days in a stretch is too long without a day off, I just think it's a really long*
4 *stretch...I think [the effect] is fatigue really and I suppose you learn less towards the*
5 *end of those days really because you are just tired."* (Tel. Int. 26, Foundation)
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9
10 Fatigue was also reported to affect mood, particularly when switching between different
11 working patterns, with consequences for their professional manner. This may have
12 consequences for team-working and interprofessional communication, as well as for
13 interactions with patients.
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19 *"You become more irritable sometimes as well, I noticed I was a bit more snappy*
20 *[when switching between long days and nights]* (Focus group 5, Foundation)
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23
24 *"You don't make as good decisions and you're more grumpy, you're less likely to be*
25 *good with the patients, you know, you're more likely to just go in there and take the*
26 *blood rather than actually you know being a doctor to them...so you have to be a lot*
27 *more careful when you're tired I suppose."* (Tel. Int. 9, Foundation)
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34 These issues were sometimes compounded by hunger and discomfort arising from not
35 achieving rest breaks during long shifts.
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38
39 *"I think when I'm hungry my fuse is shorter and I think my compassion towards others*
40 *is not as what it should be."* (Tel. Int. 2, Foundation)
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44
45 A summary of the Findings is presented in Table 3 below.
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47

48 Table 3. Summary of findings
49

Overall findings	Detail of findings
Perceived effects of WTR on working hours	General agreement that working hours were much improved under WTR; 48-hour limit appropriate (but desire for greater flexibility); intended benefits achieved to some extent
Implementation of WTR in practice: effects on fatigue	Different shift systems and patterns of work (timing and adjustment). Long periods without a day off. Averaging over 26 weeks can still allow over 48 working hours in one week.

	Work compression/work intensity. Rest periods not always taken.
Drivers to work long hours	Workload/completion of tasks. Taking up educational opportunities at work. Taking work home. Commitment and responsibility to patients and colleagues; collegiality. Cultural expectations. Professional reputation. Views of nature of professionalism. Workforce issues.
Effects of fatigue	Detriment to skills and judgement: most felt to affect efficiency rather than safety. Negative effect on ability to retain new information. Mood and manner (compounded by physical discomfort and hunger)

Discussion

Despite the introduction of restricted working hours for junior doctors in the UK, long hours and fatigue remain, with associated consequences for performance. There was general agreement that restricting working hours was a positive thing, but that problems remained with acute workload in some working patterns. Conversely, while most felt that a 48 hour limit was appropriate, some would like more flexibility to exceed it when necessary.

It was considered that the amount of work to be carried out had not reduced, increasing the perceived intensity of work. Some working patterns were considered particularly intense and detrimental to personal well-being – with consequences for performance and education.

Long periods without a day off in particular were tiring. There is no objective record of hours worked, as WTR compliance is derived from New Deal monitoring reports, and trainees reported no formal measures for health and well-being.

There was evidence that the design of rotas was not the only factor working against well-being. Trainees were often working beyond their rostered hours for voluntary reasons of workload, perceived need to gain educational opportunities, and collegiality, but also for more external reasons such as the expectations of others and gaps in the rota. Notably these are corollaries of the voluntary reasons – rota gaps increase workload, and adverse cultures may define professional practice. Contrary to recent recommendations that ‘every

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3 moment count' towards education in the workplace,⁴² for some trainees at least there is
4 increasing separation between work and education, and an increase in work intensity that
5 may be adding new stresses to the trainee population.
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10 The current study provides evidence that three years after the implementation of the WTR,
11 and with rotas that are at least compliant on paper, fatigue remains an issue for doctors in
12 training. This reflects some findings in the literature that a reduction in working hours alone is
13 not enough. The issue of increased work intensity and greater stress was noted amongst US
14 residents when working hours were further restricted.⁴³ Performing the same amount of work
15 in fewer hours (work compression) is of concern regarding workload⁴⁴ and overall well-
16 being,⁴⁵ and may place trainee doctors at risk of burnout.⁴⁶ Although much of the literature
17 relating to fatigue comes from the USA where restricted working hours are still much longer
18 than in Europe (e.g. >24 hour shifts until 2011, or 80-hour weeks), two UK self-report studies
19 conducted shortly after implementation of the 48-hour working week have highlighted the
20 effect of different schedules on fatigue, including the negative effect of working seven
21 consecutive nights, having only one day of rest after night shifts, intervals of less than ten
22 hours between shifts, and shifts of twelve consecutive days.^{30 31} Difficulty achieving naps
23 during night shifts, and poor provision for naps, has been reported elsewhere.³³ The current
24 study has identified that fatigue is related to a number of complex issues, including rota
25 design, but also including contextual issues such as staff shortages and rota gaps, and
26 broader professional and cultural issues.
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46 Cultural issues within healthcare have been found to include fatigue not being taken
47 seriously, lack of discussion of fatigue issues and lack of support for napping.⁴⁷ The culture
48 of medicine needs to value sleep and appropriate work schedules.⁴⁸ Long working hours
49 may be a symptom of, and contribute to, an adverse culture. Expectations of long hours,
50 coupled with a lack of their explicit recognition, may be symptomatic of 'institutionalised
51 disrespect' of workers,³⁴ which if it is felt to be normal may lead to further dysfunctional
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3 behaviours. Culture, particularly at the level of basic underlying assumptions that may
4 underpin day-to-day work, can be extremely difficult to change.^{34 49} In a study of paramedics,
5 podiatrists and occupational therapists, the working environment has also been found to be
6 an important factor in encouraging and developing professionalism.^{44 50} and sSome trainees
7 in the current study felt undermined by aspects of the professional and organisational culture
8 and felt there was a lack of recognition of the extra hours they worked.
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16 In other professions and industries the organisation of work, and the professional and
17 organisational cultures they engender or reinforce (such as a culture of long working hours;
18 cultural attitudes towards napping), has also been linked to fatigue, performance, safety,
19 health and well-being. Such professions and industries include nursing,⁵¹ aviation,⁵² the
20 police,⁵³ truck driving,⁵⁴ the shipping industry⁵⁵ and the construction industry.⁵⁶ It has also
21 been found, in a study of metropolitan train drivers, that the successful adoption of fatigue
22 management strategies can be positively or negatively affected by aspects of the
23 organisational culture, such as altruism and camaraderie.⁵⁷ A culture of denial of vulnerability
24 to stress and the effects of fatigue on performance has been identified in both aviation and
25 medicine,⁵⁸ although one study found this to a lesser extent in aviation.⁵⁹
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38 Work hours are closely related to psychosocial work characteristics such as work demands
39 and autonomy.⁶⁰ Optimal amount and quality of workload, and opportunities for control at
40 work are among the psychosocial criteria identified for a good work environment and good
41 work organisation, and typically show dependence on national and organisational culture
42 and values,⁶¹ however individual differences in the desire or need for control need to be
43 taken into account.⁶² High work demands and work intensity, and lack of autonomy (and
44 particularly a combination of these) have been associated with health problems.⁶³ In a study
45 of US nurses, high job demands were associated with greater fatigue when job control was
46 low.⁶⁴ Ability to influence working hours (worktime control) has been associated with fewer
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3 subjective health complaints,⁶⁵ and with decreased work strain and decreased perceived
4 stress.⁶⁶
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9 The broader cultural issues identified in relation to trainees' professional autonomy and the
10 relationship between trainees and their seniors are of current relevance in light of the Francis
11 report's recommendations for fundamental culture change in the NHS.⁴⁵⁶⁷ Following these
12 recommendations, it has been argued that more sophisticated understandings of cultural
13 dynamics and the role of policy in shaping these may be needed.⁴⁶⁶⁸ Fatigue may be an
14 important mediating variable in the perpetuation of adverse cultures and practice failings,
15 and as such should be an important component of any policies to monitor and improve
16 workplace cultures.
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25 Evaluation of the WTR must be considered in relation to the historical context within which
26 they were implemented. Perceptions of the WTR were not isolated from other changes
27 affecting working hours, particularly the 1991 New Deal for Junior Doctors, which imposed
28 restrictions for the first time. At an organisational level, changes relating to the reorganisation
29 of specialty training over the last 20 years⁴⁷⁶⁹ affected the working environment. Trainees
30 now have to settle on a career specialty training path sooner, meaning that the Senior House
31 Officer (SHO) posts they would have filled in other specialties for up to several years may
32 remain unfilled. These gaps are compounded by the reduction in the number of overseas-
33 qualified doctors entering the UK following changes to immigration policy in 2008. The
34 workload and hence fatigue experienced by individual trainees can therefore be seen as the
35 end-point of many contributory factors.
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48 49 **Strengths and limitations**

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51 The strength of the current study is the breadth of trainee participants, covering a range of
52 training grades and specialties and all four nations of the UK, so gaining a picture across the
53 trainee experience. A weakness is that the trainee participants were volunteers to the study,
54 and as such may be open to self-selection bias. However, this risk is mitigated by the
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3 instance of one group, run as part of Foundation Programme teaching, where all but four of
4
5 a cohort of F1s were able to attend. That group identified the same issues as the wider
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7 sample, suggesting the prevalence of the concerns identified is not limited to a particularly
8
9 engaged sample. There may also be some instances of inaccuracy in individual recall
10
11 regarding the exact hours trainees worked.
12

13 14 **Conclusion**

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16
17 The WTR have reduced the hours junior doctors work, but have not fully addressed
18
19 problems of fatigue and stress, due to issues in their implementation and other contextual
20
21 factors. The long term risks of this continued stress and fatigue, for the doctors themselves
22
23 and for the effective delivery of a healthcare service, should not be ignored.
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27 Future research could usefully involve an investigation of work intensity and its effects on
28
29 doctors' education, performance and well-being, and its impact on patient care. Such
30
31 research should consider the clinical demands of different specialties and the working
32
33 environment. Policy and practice could consider how best to monitor both working hours and
34
35 doctors' well-being. The closer and more effective involvement of trainees in rota design,
36
37 with consideration of the physiological aspects of sleep and fatigue, may help to avoid some
38
39 stresses, but there may need to be more fundamental consideration of necessary staffing
40
41 levels.
42

43 44 **Acknowledgements**

45
46
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49 trainee doctors who took part in focus groups or telephone interviews.
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References

1. Morrow G, Burford B, Carter M, *et al.* *The Impact of the Working Time Regulations on medical education and training: Literature review.* Report to the GMC, August 2012.
http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training___Literature_Review.pdf_51155615.pdf
2. Ayas NT, Barger LK, Cade BE, *et al.* Extended work duration and the risk of self-reported percutaneous injuries in interns. *JAMA* 2006;296:1055-62.
3. Fisman DN, Harris AD, Rubin M, *et al.* Fatigue increases the risk of injury from sharp devices in medical trainees: results from a case-crossover study. *Infect Cont Hosp Ep* 2007;28:10-17.

- 1
2
3 4. Barger LK, Ayas NT, Cade BE, *et al.* Impact of extended-duration shifts on medical
4 errors, adverse events, and attentional failures. *PLOS Med* 2006;3:e487.
- 5
6
7 5. Gander P, Purnell H, Garden A, *et al.* Work patterns and fatigue-related risk among
8 junior doctors. *Occup Environ Med* 2007;64:733-738.
- 9
10
11 6. Kohen-Raz R, Himmelfarb M, Tzur S, *et al.* An initial evaluation of work fatigue and
12 circadian changes as assessed by multiplate posturography. *Percept Motor Skill*
13 1996;82:547-557.
- 14
15
16
17 7. Parshuram CS, Dhanani S, Kirsh JA, *et al.* Fellowship training, workload, fatigue and
18 physical stress: A prospective observational study. *Can Med Assoc J* 2004;170:965-970.
- 19
20
21 8. Smith AM, Morris P, Rowell KO, *et al.* Junior doctors and the full shift rota - psychological
22 and hormonal changes: a comparative cross-sectional study. *Clin Med* 2006;6:174-177.
- 23
24
25 9. Block L, Wu AW, Feldman L, *et al.* Residency schedule, burnout and patient care among
26 first-year residents. *Postgrad Med J* 2013;89:495-500.
- 27
28
29 10. Gohar A, Adams A, Gertner E, *et al.* Working memory capacity is decreased in sleep-
30 deprived internal medicine residents. *J Clin Sleep Med* 2009;5:191-197.
- 31
32
33 11. Lockley SW, Cronin JW, Evans EE, *et al.* Effect of reducing interns' weekly work hours
34 on sleep and attentional failures. *New Engl J Med* 2004;351:1829-1837.
- 35
36
37 12. Jakubowicz DM, Price EM, Glassman HJ, *et al.* Effects of a twenty-four hour call period
38 on resident performance during simulated endoscopic sinus surgery in an Accreditation
39 Council for Graduate Medical Education-compliant training program. *Laryngoscope*
40 2005;115:143-146.
- 41
42
43 13. Gander P, Millar M, Webster C, *et al.* Sleep loss and performance of anaesthesia
44 trainees and specialists. *Chronobiol Int* 2008; 25:1077-1091.
- 45
46
47 14. Brandenberger J, Kahol K, Feinstein AJ, *et al.* Effects of duty hours and time of day on
48 surgery resident proficiency. *Am J Surg* 2010;200:814-818.
- 49
50
51 15. Ellman PI, Law MG, Tache-Leon C, *et al.* Sleep deprivation does not affect operative
52 results in cardiac surgery. *AnnThorac Surg* 2004;78:906-911.
- 53
54
55
56
57
58
59
60

- 1
2
3 16. Lehmann KS, Martus P, Little-Elk S, *et al.* Impact of sleep deprivation on medium-term
4 psychomotor and cognitive performance of surgeons: prospective cross-over study with
5 a virtual surgery simulator and psychometric tests. *Surgery* 2010;147:246-254.
6
7
8
9 17. Grantcharov TP, Bardram L, Funch-Jensen P, *et al.* Laparoscopic performance after one
10 night on call in a surgical department: prospective study. *Brit Med J* 2001;323:1222-3.
11
12
13 18. Landrigan CP, Rothschild JM, Cronin JW, *et al.* Effects of reducing interns' work hours
14 on serious medical errors in intensive care units. *New Engl J Med* 2004;351:1838-1848.
15
16
17 19. Lockley SW, Landrigan CP, Barger LK, *et al.* Harvard Work Hours, Health Safety Group.
18 When policy meets physiology: the challenge of reducing resident work hours. *Clin*
19 *Orthop Relat R* 2006;449:16-127.
20
21
22 20. Majekodunmi A, Landrigan CP. The effect of physician sleep deprivation on patient
23 safety in perinatal-neonatal medicine. *Am J Perinat* 2012;29:43-48.
24
25
26 21. Vorona RD, Chen IA, Ware JC. Physicians and sleep deprivation. *Sleep Medicine Clinics*
27 2009;4:527-540.
28
29
30 22. Paice E, Hamilton-Fairley D. Avoiding burnout in new doctors: sleep, supervision and
31 teams. *Postgrad Med J* 2013;89:493.
32
33
34 23. Sokol DK. Waking up to the effects of fatigue in doctors. *Brit Med J* 2013;347:f4906
35
36
37 24. Conigliaro J, Frishman WH, Lazar EJ, *et al.* Internal medicine housestaff and attending
38 physician perceptions of the impact of the New York State Section 405 regulations on
39 working conditions and supervision of residents in two training programs. *J Gen Intern*
40 *Med* 1993; 8:502-507.
41
42
43 25. Kort KC, Pavone LA, Jensen E, *et al.* Resident perceptions of the impact of work-hour
44 restrictions on health care delivery and surgical education: time for transformational
45 change. *Surgery* 2004;136:861-871.
46
47
48 26. Kiernan M, Civetta J, Bartus C, *et al.* 24 hours on-call and acute fatigue no longer
49 worsen resident mood under the 80-hour work week regulations. *Curr Surg* 2006;63:237-
50 241.
51
52
53
54
55
56
57
58
59
60

- 1
2
3 27. Cull WL, Mulvey HJ, Jewett EA, *et al.* Pediatric residency duty hours before and after
4 limitations. *Pediatrics* 2006;118:e1805-1811.
5
6
7 28. Reddy R, Guntupalli K, Alapat P, *et al.* Sleepiness in medical ICU residents. *Chest*
8
9 2009;135:81-85.
10
11 29. Berios I, Surani S, Simmons M. Assessing reaction time among emergency medicine
12 residents working different shift hours. *Ann Emerg Med* 2009; 54: S35.
13
14 30. Brown M, Tucker P, Rapport F, *et al.* The impact of shift patterns on junior doctors'
15 perceptions of fatigue, training, work/life balance and the role of social support. *Qual Saf*
16
17 *Health Care* 2010;19:e36.
18
19 31. Tucker P, Brown M, Dahlgren A, *et al.* The impact of junior doctors' worktime
20
21 arrangements on their fatigue and well-being. *Scand J Work Env Hea* 2010;36:458-46
22
23 32. Arora V, Dunphy C, Chang VY, *et al.* The effects of on-duty napping on intern sleep time
24
25 and fatigue. *Ann Intern Med* 2006;144:792-798.
26
27 33. Jackson EJ, Moreton A. Safety during night shifts: a cross-sectional survey of junior
28
29 doctors' preparation and practice. *BMJ Open* 2013 3: doi: 10.1136/bmjopen-2013-
30
31 003567.
32
33 34. Leape LL, Shore MF, Dienstag JL, *et al.* A culture of disrespect, Part 1: The nature and
34
35 causes of disrespectful behavior by physicians. *Acad Med* 2012;87:845-852.
36
37 35. O'Gallagher MK, Lewis G, Mercieca K, *et al.* The impact of the European Working Time
38
39 Regulations on Ophthalmic Specialist Training - A national trainee survey. *Int J Surg*
40
41 2013: <http://dx.doi.org/10.1016/j.ijsu.2013.08.007>
42
43 36. Illing JC, Carter M, Thompson NJ, *et al.* *Evidence synthesis on the occurrence, causes,*
44
45 *consequences, prevention and management of bullying and harassing behaviours to*
46
47 *inform decision making in the NHS. Final report.* NIHR Service Delivery and Organisation
48
49 programme; 2013.
50
51 37. Williams ES, Konrad TR, Scheckler WE, *et al.* Understanding physicians' intentions to
52
53 withdraw from practice: the role of job satisfaction, job stress, mental and physical
54
55 health. *AHCM* 2001;2:243-262.
56
57
58
59
60

- 1
2
3 38. Edwards N, Kornacki MJ, Silversin J. Unhappy doctors: what are the causes and what
4 can be done? *Brit Med J* 2002;324:835-8.
5
6
7 39. Visser MRM, Smets EMA, Oort FJ, *et al.* Stress, satisfaction and burnout among Dutch
8 medical specialists. *CMAJ* 2003;168:271-5.
9
10
11 40. Morrow G, Burford B, Carter M, *et al.* *The Impact of the Working Time Regulations on*
12 *medical education and training: Final report on primary research.* Report to the GMC,
13 August 2012. [http://www.gmc-](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf_51157039.pdf)
14 [uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Tr](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf_51157039.pdf)
15 [aining_Final_Report_on_Primary_Research.pdf_51157039.pdf](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf_51157039.pdf)
16
17
18
19
20
21 41. Ritchie J, Spencer L. Qualitative data analysis for applied policy research. In: Bryman A,
22 Burgess RG, editors. *Analysing Qualitative Data.* London: Routledge; 1994. p.173-194.
23
24
25 42. Temple J. Time for Training: A review of the impact of the European Working Time
26 Directive on the quality of training. 2010.
27
28 http://www.mee.nhs.uk/pdf/JCEWTD_Final%20report.pdf
29
30
31 43. Auger KA, Sieplinga KR, Simmons JM, *et al.* Failure to thrive: Pediatric residents weigh
32 in on feasibility trial of the proposed 2008 Institute of Medicine work hour restrictions. *J*
33 *Grad Med Educ* 2009;1:181-184.
34
35
36
37 44. Goitein L. Resident workload – Let’s treat the disease, not just the symptom. *JAMA*
38 *Intern Med* 2013;173:655-656.
39
40
41 45. Auger KA, Landrigan CP, Gonzalez del Ray JA, *et al.* Better rested but more stressed?
42 Evidence of the effects of resident work hour restrictions. *Acad Pediatr* 2012;12:335-343.
43
44
45
46 46. Wayne DB, Arora V. Resident duty hours and the delicate balance between education
47 and patient care. *J Gen Intern Med* 2008;23:1120-1121.
48
49
50 47. Ferguson SA, Neall A, Dorrian J. Strategies used by healthcare practitioners to manage
51 fatigue-related risk: beyond work hours. *Medical Sociology online* 2013;7:24-33.
52
53 <http://www.medsoconline.org/>
54
55
56 48. Buysse DJ, Barzansky B, Dinges D, *et al.* Sleep, fatigue, and medical training: setting an
57 agenda for optimal learning and patient care. A report from the Conference “Sleep,
58
59
60

- 1
2
3 fatigue and medical training: Optimizing learning and the patient care environment".
4
5 *Sleep* 2003;2:218-225.
6
- 7 49. Schein EH. Organisational culture and leadership. 4th edn. Jossey-Bass, 2010.
8
- 9 50. Morrow G, Burford B, Rothwell C, *et al.* Carter M, McLachlan J, Illing J. *Professionalism*
10 *in healthcare professionals. Perceptions of professionalism.* Final report to the hpc,
11
12 2011. <http://www.hpc->
13
14 [uk.org/assets/documents/10003771Professionalisminhealthcareprofessionals.pdf](http://www.hpc-uk.org/assets/documents/10003771Professionalisminhealthcareprofessionals.pdf)
15
16
- 17 51. Rogers AE. The effects of fatigue and sleepiness on nurse performance and patient
18
19 safety. In: Hughes RG. editor. *Patient safety and quality: An evidence-based handbook*
20
21 *for nurses.* Rockville (MD): Agency for Healthcare Research and Quality (US); 2008.p2-
22
23 509-2-533.
24
- 25 52. Gregory KB, Winn W, Johnson K, *et al.* Pilot fatigue survey: Exploring fatigue factors in
26
27 air medical operations. *Air Med J* 2010;29:309-319.
28
- 29 53. Vila B. Impact of long work hours on police officers and the communities they serve. *Am*
30
31 *J Ind Med* 2006;49:972-980.
32
- 33 54. Sabbagh-Ehrlich S, Friedman L, Richter E. Working conditions and fatigue in
34
35 professional truck drivers at Israeli ports. *Inj Prev* 2005;11:110-114.
36
- 37 55. Xhelilaj E, Lapa K. The role of human fatigue factor towards maritime casualties.
38
39 *Maritime Transport & Navigation Journal* 2010;2:23-32.
40
- 41 56. Dong X. Long workhours, work scheduling and work-related injuries among construction
42
43 workers in the United States. *Scand J Work Environ Health* 2005;31:329-335.
44
- 45 57. Rainbird S, Thompson K, Dawson D. The impact of organisational culture on fatigue
46
47 management: The case of camaraderie amongst metropolitan train drivers. In: Sargent
48
49 C, Darwent D, Roach GD. editors. *Living in a 24/7 world: The impact of circadian*
50
51 *disruption on sleep, work and health.* Adelaide: Australasian Chronobiology Society;
52
53 2010.p.29-33.
54
- 55 58. Helmreich RL. On error management: lessons from aviation. *Brit Med J* 2000;320:781-
56
57 785.
58
59
60

- 1
2
3 59. Sexton JB, Thomas EJ, Helmreich RL. Error, stress and teamwork in medicine and
4 aviation: cross sectional surveys. *Brit Med J* 2000;320:745-749.
5
6
7 60. Härmä M. Workhours in relation to work stress, recovery and health. *Scand J Work*
8 *Environ Health* 2006;32:502-514.
9
10
11 61. Lindström K. Psychosocial criteria for good work organization. *Scand J Work Environ*
12 *Health* 1994;20:123-133.
13
14
15 62. Sparks K, Faragher B, Cooper CL. Well-being and occupational health in the 21st
16 century workplace. *J Occup Organ Psych* 2001;74:489-509.
17
18
19 63. Eurofound. Fifth European working conditions survey. Publications Office of the
20 European Union, Luxembourg, 2012.
21
22 <http://www.eurofound.europa.eu/pubdocs/2011/82/en/1/EF1182EN.pdf>
23
24
25 64. Van Yperen NW, Hagedoorn M. Do high job demands increase intrinsic motivation or
26 fatigue or both? The role of job control and job social support. *Acad Manage J*
27 2003;46:339-348.
28
29
30
31 65. Costa G, Akerstedt T, Nachreiner F, *et al.* Flexible working hours, health, and well-being
32 in Europe: some considerations from a SALTSA project. *Chronobiol Int* 2004;21:831-
33 844.
34
35
36
37 66. Kandolin I, Huida O. Individual flexibility: an essential pre-requisite in arranging shift
38 schedules for midwives. *J Nurs Manag* 1996;4:213-217.
39
40
41 67. Francis R. *Report of the Mid Staffordshire NHS Foundation Trust public inquiry.*
42 Stationery Office, 2013.
43
44
45 68. Davies H, Mannion R. Will prescriptions for cultural change improve the NHS? *Brit Med J*
46 2013;346:f1305.
47
48
49 69. HMSO. Hospital Doctors: Training for the future. The report of the working group on
50 specialist medical training. HMSO, 1993.
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4 **Have restricted working hours reduced junior doctors' experience of fatigue? A**
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6 **qualitative focus group and telephone interview study**
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ABSTRACT

Objectives: To explore the effects of the UK Working Time Regulations (WTR) on trainee doctors' experience of fatigue.

Design: Qualitative research

Setting: Nine deaneries in all four UK nations of the UK; secondary care

Participants: Focus groups or telephone interviews were conducted with trainee doctors purposively selected from Foundation Years One and Two and specialty training in the nine deaneries. ~~82~~ **Eighty-two** junior doctors participated: 53 Foundation Programme trainees (40 in Foundation Year 1, 13 in Foundation Year 2) and 29 specialty trainees. Thirty-six participants were male, and 46 were female. Specialty trainee participants were ~~training in~~ **from** a wide range of medical and surgical specialties, and psychiatry.

Findings: The implementation of the WTR, whilst acknowledged to be an improvement to the earlier situation of prolonged excessive hours, has not wholly overcome experience of long working hours and fatigue. Fatigue did not just arise from ~~scheduled hours specified in rota design,~~ **but also from an unpredictable mixture of shifts, work intensity, which often resulted in educational tasks being taken home, and inadequate rest. It was also caused by** ~~Trainees working beyond their rota, for rostered hours.~~ **reasons including completing tasks, accessing educational opportunities outside scheduled hours and staffing issues.** ~~including some voluntary, and other~~ **There were also** organisational, professional and cultural ~~and contextual reasons~~ **factors, such as a sense of responsibility to patients and colleagues and the expectations of seniors.** Fatigue was perceived to affect efficiency of skills and judgement, mood, and learning capacity.

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3 **Conclusions:** The ~~Long~~ term risks of this continued stress and fatigue, for the doctors
4 themselves and for the effective delivery of a healthcare service, should not be ignored.
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6 Current monitoring and quality management processes may need to be reviewed to increase
7 their sensitivity to issues ~~regarding rotas and~~ arising from hours worked. Effects on fatigue
8 and on education cannot be isolated from other contextual factors, including workforce
9 issues numbers. On-going attention needs to be paid to broader cultural issues, including for
10 example in relation to trainees' professional autonomy and the relationship between trainees
11 and their seniors.
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ARTICLE SUMMARY

Article focus

The aim of the paper is to explore the effects of the UK Working Time Regulations (WTR) on trainee doctors' experience of fatigue.

Key messages

- The implementation of the WTR, whilst acknowledged to be an improvement to the earlier situation of prolonged excessive hours, has not wholly overcome experience of long working hours and fatigue. **Reasons for persistent fatigue include the organisation of working patterns, work compression and intensity - thus also taking more work home – and working longer than rostered hours. This was related to taking up extra educational opportunities at work and to professional and organisational culture, including trainees' sense of responsibility towards patients and colleagues and the expectations of seniors. Current monitoring and quality management processes may need to be reviewed to increase their sensitivity to issues regarding rotas and hours worked. Current monitoring processes lack sensitivity to issues regarding rotas and hours worked.**
- Effects on fatigue and on education cannot be isolated from other contextual factors, including workforce issues.
- On-going attention needs to be paid to broader cultural issues identified in relation to trainees' professional autonomy and **expectations placed on trainees and** the relationship between trainees and their seniors.

Strengths and limitations

- The strength of the study is the breadth of trainee participants, covering a range of training grades and specialties and all four nations of the UK.
- A potential weakness is that participants were volunteers to the study, and as such may be open to self-selection bias. However, this risk is mitigated by the instance of

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3 one group run as part of Foundation Programme teaching, where all but four of a
4 cohort of **Foundation Year One trainees (F1s)** were able to attend. That group
5 identified the same issues as the wider sample, suggesting the prevalence of the
6 issues identified is not limited to a particularly engaged sample. **There may also be**
7 **potential inaccuracies in individual recall of hours worked.**
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3 **Title: Have restricted working hours reduced junior doctors' experience of fatigue? A**
4 **qualitative focus group and telephone interview study**
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8 **Introduction**
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12 There is a considerable body of evidence recognising that fatigue has adverse physiological,
13
14 psychological and cognitive effects and can lead to deficits in performance and safety.¹

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16 Fatigue in doctors is associated with increases of risks to personal safety at work^{2 3} and
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18 outside work,^{4 5} and risks to health and well-being.⁶⁻⁹ There is also evidence of detriments to
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20 performance, for example in cognitive abilities^{10 11} and psychomotor skills,¹²⁻¹⁴ (although
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22 some studies have found no performance effects^{15 16}). Fatigue has also been associated
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24 directly with negative consequences for patient safety such as clinical errors and diagnostic
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26 mistakes.^{4 5 17-20} This has been a concern in medicine for several years²¹ and remains so
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28 today.^{22 23} The effects may be compounded by a risk that doctors do not recognise that they
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30 may be subject to adverse effects.²³
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34 Several countries have introduced limits on working hours. For example, in the USA, since
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36 2003, there has been national implementation of an Accreditation Council for Graduate
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38 Medical Education (ACGME) 80-hour resident work week restriction, averaged over four
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40 weeks; however the limit is lower in Europe. The European Working Time Directive (EWTD)
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42 was introduced to limit hours, to address health and safety concerns for all workers arising
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44 from long hours. Each European Union member state implemented the Directive in its own
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46 legislation – the UK as the Working Time Regulations (1998). These Regulations (the WTR)
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48 have applied fully to junior doctors since 2009, with a limit of 48 hours per week, averaged
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50 across a reference period of 26 weeks, alongside specified minimum rest periods. The WTR
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52 are implemented in rotas (**work schedules**) alongside the New Deal, which specifies a
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54 maximum of 56 hours per week, with a system of banded payments.
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3 Positive effects of a reduction in working hours have been found in many studies,²⁴⁻²⁶ but not
4 all.^{27 28} The effect varies with the precise implementation of restrictions, with fatigue affected
5 by work patterns including the number of consecutive days or nights worked, the intervals
6 between shifts, and the timing of shifts (day/evening/night).²⁹⁻³¹ Short naps may ameliorate
7 the negative effects of fatigue,³² and awareness of the benefits of naps and other
8 recommendations and interventions to limit fatigue associated with rotating shift work may
9 be needed.³³

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18 Organisational cultures of long or antisocial hours³⁴ may also be a factor impacting on stress
19 and fatigue, and trainees have reported being unofficially expected to work extra hours
20 voluntarily.³⁵ Furthermore workload pressures and poor work design may increase risks of
21 negative behaviours among staff.³⁶ Limits on professional autonomy – the amount of control
22 doctors have traditionally held over their practice – may also increase doctors' stress and
23 reduce job satisfaction.³⁷⁻³⁹

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32 Consequently, simply restricting the number of work hours may be insufficient to address
33 issues relating to fatigue and its consequences. With this in mind, the question is raised
34 whether the WTR will have achieved the aim of improving junior doctors' well-being and
35 fatigue. To date, there has been little research looking directly at the effects of the WTR as
36 implemented and experienced in practice. This paper draws on a larger research study
37 considering perceptions of the effects of the WTR,⁴⁰ and focuses specifically on their effects
38 on trainee doctors' fatigue.

47 48 **Method**

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51 The research was reviewed by the Durham University School of Medicine, Pharmacy and
52 Health Ethics Sub-Committee, and a favourable ethical opinion received.

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56 Focus groups and telephone interviews (with participants who were unable to attend a focus
57 group) were conducted with Foundation Year One (FY1) and Foundation Year Two (FY2)

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3 trainees and specialty trainees, sampled purposively from nine deaneries in all four nations
4 of the UK. The Foundation Programme is a two-year generic training programme undertaken
5 after completing medical school, and is followed by specialist or general practice training.
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7 The WTR apply to all years of training in the same way. Trainees were asked about their
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9 experience and perceptions of working hours following the WTR.
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14 The focus group topic guide and interview questions focused on perceptions and experience
15 of working hours following the WTR and any educational or personal impact. Trainees were
16 asked about their knowledge of the WTR; their perceptions of their working hours in practice,
17 including shifts, rotas and compliance; issues concerning educational opportunities;
18 monitoring of working hours, and any personal effects they experienced. Some specialty
19 trainees had experience of working before the introduction of the WTR, and were asked
20 about the change.
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29 Recruitment was undertaken following local advice; in some cases through the Deanery, in
30 others through education centres in individual hospitals. An information sheet about the
31 study was distributed to trainees via email from the Deaneries or individual Trusts, and
32 participation was on a voluntary basis. Written consent was taken at the start of focus groups
33 and verbal consent at the start of telephone interviews, including consent for audio
34 recording. Recordings were later transcribed. GM and BB conducted the focus groups and
35 telephone interviews. Focus groups lasted between 60 and 90 minutes, and telephone
36 interviews between 30 and 45 minutes.
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46 Analysis

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49 Data were analysed using a framework approach.⁴¹ An initial stage of familiarisation, with the
50 data, to gain an overall view of the data, involved reading the transcripts and noting the
51 range and depth in the data collected. Meetings between all four researchers engaged in this
52 process (GM, BB, MC, JI) enabled discussion of the concepts and themes that emerged
53 from the data. A thematic framework was subsequently identified by GM and BB. This
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involved identifying the key issues, concepts or themes by which the data could be examined and sorted. The construction of the framework drew upon:

- *a priori* issues - those issues that were known or assumed to be pertinent, that guided the study aims and were developed into the topic guide/interview schedule;
- *emergent* issues - those issues that were raised by the respondents (e.g. issues relating to work intensity);
- *analytic* issues - those themes that emerged from patterns and re-occurrences in the data (e.g. professionalism)

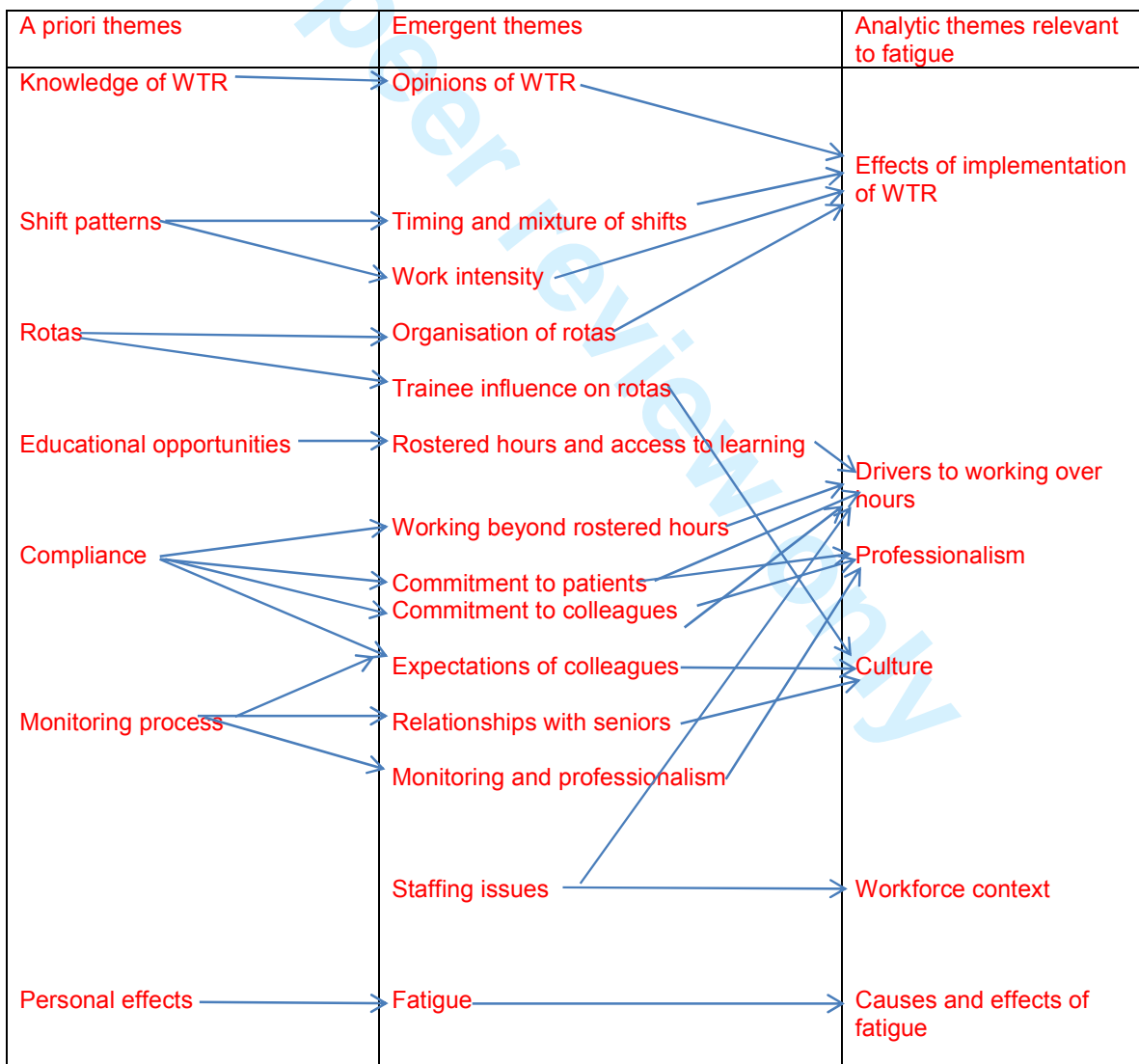
The framework was then applied to the data by GM and BB through indexing and charting, and themes and sub-themes were further refined. Finally, a stage of mapping and interpretation involved bringing the key themes within the data set together and pulling together the findings of the analysis as a whole. Table 1 summarises the main *a priori* themes, emergent themes, and analytic themes related to fatigue and illustrates the mapping and interpretation of the themes. The process of analysis helped provide an explanation of why fatigue remains an issue, and of the inter-relatedness of the issues identified.

~~drawing upon *a priori* issues, *emergent* issues that were raised by respondents (e.g. issues relating to work intensity), and *analytic* issues. — those themes that emerged from patterns and re-occurrences in the data (e.g. professionalism).~~ Data from focus groups and telephone interviews were analysed concurrently and no differences in themes were identified.

Table 1. Development of themes in framework analysis

A priori themes	Emergent themes	Analytic themes relevant to fatigue
Knowledge of WTR	Opinions of WTR	Effects of WTR implementation on fatigue
Shift patterns	Work intensity	Effects of fatigue
Rotas	Trainee influence on rotas	Drivers to working
Compliance	Working beyond rostered hours	

Educational opportunities	Rostered hours and access to learning opportunities	over hours
Monitoring process	Commitment to patients	Professionalism
Personal effects	Commitment to colleagues	Culture
	Expectations of colleagues	
	Monitoring and professionalism	
	Relationships with seniors	
	Fatigue	



Findings

Eleven focus groups and 30 telephone interviews were conducted with 82 junior doctors.

See Table 2 for details of the training grades of participants.

Table 2. Training grades of participants

Foundation Year 1 (FY1)	Foundation Year 2 (FY2)	Core or specialty training up to CT/ST3*	ST4 or higher **
40	13	7	22
Total Foundation trainees: 53		Total specialty trainees: 29	

* These are trainees in the first three years of their specialty training, and were likely to have started specialty training after the WTR introduction in 2009.

** These are in higher specialty training, in their fourth year or above.

Thirty-six participants were male and 46 were female. Specialty trainee participants were training in a wide range of medical and surgical specialties, and psychiatry.

Perceived effects of WTR on working hours

There was general agreement that working hours were much improved under the WTR, and that intended benefits in terms of reduced trainee fatigue and improved work-life balance had been achieved to some extent. Many trainees felt that the 48-hour limit was appropriate and enabled sufficient training experience, albeit with a perceived lack of flexibility.

"I think, speaking to people who didn't have the forty-eight hour working time directive thing, we get a lot more time to go home and enjoy ourselves and be outside the hospital than they ever did and I think that's a good thing, I feel like I've got a bit more of a life." (Tel. Int. 22, Foundation)

However, some participants did report still working long hours and experiencing fatigue despite the 48-hour limit and this was found to be related to a number of factors including the

1
2
3 way in which the Regulations were implemented and other organisational and contextual
4
5 factors.

6
7
8 ~~Effects of WTR implementation on fatigue~~ Implementation of WTR in practice: effects on
9 fatigue

10
11 However, some participants did report still working long hours and experiencing fatigue
12
13 despite the 48-hour limit and this was found to be related to a number of factors including the
14
15 way in which the Regulations were implemented and other organisational and contextual
16
17 factors.
18

19
20 The WTR have not entirely eliminated long hours, with some trainees giving examples of
21
22 working up to 100 hours in a week. However, fatigue did not necessarily arise just from the
23
24 long hours worked, but also the organisation of work within those hours, for example the
25
26 mixture of day and night shifts, and long shifts straddling day and night (e.g. 2.00pm to
27
28 2.00am). Rotas could involve five consecutive days at work with 13-hour shifts, and working
29
30 up to 12 consecutive days or, for some, seven consecutive nights (despite Royal College
31
32 recommendations to the contrary). Trainees reported that averaging meant that a working
33
34 week could exceed 70 hours and remain compliant.
35

36
37
38 *"I don't think the hours are long, so doing a 12 hour day or 13 hour day is fine, I think*
39
40 *doing 12 days in a row you hit delirium about day ten and then you over-ride it...so I*
41
42 *don't think it's the shift I think it's the number of days you work in a row."* (Focus
43
44 group 3, Foundation)

45
46
47 *"There's no continuity in terms of predictability of, right this is what I'm doing and, for*
48
49 *example, my rota you run an eight cycle rota so you've got eight weeks to get*
50
51 *through and none of those eight weeks are the same at all, and you jump around with*
52
53 *longs and lates in-between and I think that from my side is what creates fatigue."*
54
55 (Focus group 10, Specialty)
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57
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3 *“That was a particularly difficult shift on the assessment suite because you would go*
4 *from five long days with maybe two days off, or a day off sometimes, and then onto a*
5 *period of nights, you are constantly swapping from nights to days which was tiring,*
6 *and 12 hour shifts and 13 hour shifts were always a bit of a drag.”* (Tel. Int. 22,
7
8
9
10
11 Foundation)

12
13
14 There was also a perception that twelve-hour shifts were more fatiguing, with less ‘down-
15 time’ than longer but less intense on-call sessions. Work intensity was also increased by
16
17 rotas involving cross-cover out of hours.
18
19

20
21
22 *“My personal opinion is [the WTR have] actually increased fatigue and stress in the*
23 *fact that you feel you have to get an increased amount of work done in a shorter*
24 *amount of time.”* (Tel. Int. 16, Foundation)
25
26
27

28
29
30 Provision of facilities for taking rest during a night shift was also being reduced which,
31
32 alongside less capacity to take breaks or compensatory rest, added to the fatigue
33
34 experienced. Rest periods were also lost in half days – sometimes inserted into rotas to
35
36 balance hours – not always being taken, sometimes because senior clinical staff were
37
38 unaware of them, so workload did not respond to working hours.
39

40
41 *“The trouble with night shift is being able to sleep during the day and most hospitals*
42 *have no facility to actually catch a nap while on nights. The last time I worked in a*
43 *hospital with bedrooms for on-call staff was in 2007 and that’s despite guidance from*
44 *the Royal College of Physicians that it should be possible for someone to have a*
45 *short nap.”* (Tel. Int. 23, Specialty)
46
47
48
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51
52
53 *“The difficulty is you may be entitled to various half days but the chances of them*
54 *actually materialising are very slight...unless these things are really formalised and*
55 *recognised they just don’t happen. I mean you can just about get your half day off*
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3 *before nights because everyone understands that you're about to start nights...but*
4 *the rest of them just don't happen."* (Tel. Int. 19, Foundation)
5
6
7

8 ~~Fatigue did not just arise from hours specified in rota design. There were many reasons,~~
9 ~~including some voluntary, for trainees working beyond their rostered hours.~~
10
11

12 13 14 **Drivers to work long hours**

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17 *Fatigue did not just arise from hours specified in rota design. There were many reasons,*
18 *including some voluntary, for trainees working beyond their rostered (scheduled) hours.*
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22
23 Some reasons for working longer hours than scheduled stemmed from the capacity to fit
24 workload into the working period. This was more evident in shift work, where there was a
25 feeling that incoming doctors in the evening may not have the capacity to perform non-
26 urgent tasks, so the present doctor would finish those tasks before leaving. In contrast, in
27 on-call rotas a trainee would simply pass the bleep to the incoming doctor and so have a
28 cleaner handover.
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36
37 *"You kind of know yourself if I was to leave this work it's only going to be there for me*
38 *in the morning and there's a ward round in the morning, so I will have to get loads*
39 *more work handed my way. So you want to get things finished."* (Tel. Int. 2,
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Foundation)

Other drivers came from missing educational opportunities if trainees did not attend work
outside the rota, including going to work on rostered days off. These opportunities included
attending ward rounds and observing in theatre. While benefits of the WTR for work-life
balance were perceived, there was a sense that some educational activity that had been part
of the 'work' domain was now being taken home. This included portfolio completion and
reading that may have been done in the workplace during slack periods on-call.

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3 *"If you haven't got enough time to eat or go to the toilet, you can't leave work on time,*
4 *then you definitely don't have time to go to clinics, you definitely don't have time to do*
5 *audits or anything like that during work, it basically means that anything that is*
6 *exclusively for your own training is basically done in your own time and the amount of*
7 *time available to you is really diminished."* (Tel. Int. 7, Specialty)

14 Although this increased their working hours and reduced time for rest and recuperation, the
15 benefit of taking up such opportunities was often seen to outweigh this.

19
20 *"I've got no problems with the fact that I work a little bit over and take the extra time*
21 *to get training opportunities and that increases my hours to get better at my job.*
22 *That's personal sacrifice, personal advancement type stuff to get a better job to*
23 *become a consultant."* (Focus group 11, Specialty)

28
29
30 There were also professional and cultural reasons for working beyond rostered hours. These
31 related to the expectations and norms perceived among their professional group and the
32 workplace. Trainee doctors often worked beyond rostered hours due to a sense of
33 commitment and responsibility, both to patients and to colleagues. There were cases of
34 trainees staying late to hand over the care of a patient, rather than force two handovers (for
35 example where a junior doctor would stay to complete an admission in A&E, rather than
36 hand over to another FY2 doctor, who would then have to hand over to the specialty where
37 the patient was being admitted), due to concern for continuity of care and the risk of
38 information being lost. There was also a strong sense of collegiality, expressed as a
39 responsibility not to burden colleagues with routine tasks particularly as they were likely to
40 face other immediate demands at the handover time.

51
52
53 *"We have just never taken the half days because we're so busy, you know; we could*
54 *have done, but would have screwed over our colleagues."* (Focus group 2,
55 Foundation)

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3 At times, however, this could be perceived as a cultural expectation that some jobs would
4 not be left – so less a choice, more an imposition. There were references to a negative
5 culture where trainees could experience pressure from senior doctors, and other
6 professions, to stay beyond their rostered hours, with implication of unprofessionalism if they
7 left on time. There was also a perception amongst trainees that their professional reputation
8 was at risk, with implications for an employment reference and future career.
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15
16 Concerns about working hours were often not recognised or appreciated by seniors, with
17 some respondents identifying a dismissive attitude towards the WTR, and a feeling that such
18 limitations were counter to medical professionalism. Some trainees also agreed that limited
19 hours undermined professional autonomy, a feeling exacerbated if hours were enforced
20 during the periodic two-week monitoring process.
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28 *“If you clicked that you started at 8.00 and you were meant to start at 9.00, you had*
29 *to explain...why did you do it, so quite a lot of the time I wouldn't put down that I*
30 *started before 9.00 because I knew I was going to have to justify that I came in*
31 *before 9.00.”* (Focus group 5, Foundation)
32
33
34
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38 Trainees reported that, as WTR compliance is derived from these New Deal monitoring
39 reports, there was no objective record of hours worked, and there were also no formal
40 measures for health and well-being. However, few trainees kept their own record of hours
41 worked. ~~Despite their being conscious of working beyond rostered hours, few trainees kept~~
42 ~~their own record of hours worked.~~ This was partly due to their view of medicine and the
43 nature of their work, meaning that working to limited hours was not an issue to them.
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51 *“We are treated usually like we are working late due to our own failings which is not a*
52 *nice atmosphere to work in, I think it's very important that you feel you are working,*
53 *especially as a junior in a new career, you're working somewhere you are*
54 *appreciated, valued and not being looked at suspiciously.”* (Tel. Int. 21, Foundation)
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3 Gaps in rotas also placed additional pressure on the system, and so on individual doctors.
4
5 These arose from staff shortages caused by under-recruitment, as well as absences. This
6
7 often meant providing informal cover, for example in extended shifts. While locums were
8
9 used, external locums were felt to be sometimes unreliable, meaning last minute cover was
10
11 often necessary. Formal internal locum shifts were sometimes used, and cross-referenced
12
13 against rotas to ensure an individual did not exceed WTR hours, and there was no reported
14
15 pressure to undertake locum shifts. The trainees reported that there was a shortage of
16
17 available doctors to fill rotas, even without the need to comply with the WTR. Some trainees
18
19 felt that even fully staffed rotas would be stretched because the workload had increased
20
21 since the staffing levels were initially put in place.
22
23

24
25 *“The fundamental issue is trying to do a decent job and you can’t do a decent job if*
26
27 *there aren’t enough of you on the ground, so you are always working many hours in*
28
29 *excess of what you should be doing, you end up tired and exhausted and jaded and*
30
31 *then you’re not doing a good job for your patient.”* (Tel. Int. 29, Foundation)
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33

34 **Effects of fatigue**

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37 Trainees identified effects of fatigue arising from their working hours. While detriments to
38
39 their skills and judgement were identified, these were mostly felt to affect efficiency rather
40
41 than safety – however risks to patient safety cannot be discounted. Some reported that
42
43 fatigue affected their ability to retain new information.
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45

46
47 *“I think when you were getting to the end of a thirteen hour shift you found that your*
48
49 *technical skills, like your ability to put a cannula into someone and stuff like that, it*
50
51 *certainly decreases, I find it gets a lot harder to do things that require more*
52
53 *concentration, things like that, but I think you’re also quite aware of that, so patient*
54
55 *safety wise you are aware that you are not at your best so you often check more of*
56
57 *your decisions with other people and things like that.”* (Tel. Int. 22, Foundation)
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3 *"I think 12 days in a stretch is too long without a day off, I just think it's a really long*
4 *stretch...I think [the effect] is fatigue really and I suppose you learn less towards the*
5 *end of those days really because you are just tired."* (Tel. Int. 26, Foundation)
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9
10 Fatigue was also reported to affect mood, particularly when switching between different
11 working patterns, with consequences for their professional manner. This may have
12 consequences for team-working and interprofessional communication, as well as for
13 interactions with patients.
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19 *"You become more irritable sometimes as well, I noticed I was a bit more snappy*
20 *[when switching between long days and nights]* (Focus group 5, Foundation)
21
22

23
24 *"You don't make as good decisions and you're more grumpy, you're less likely to be*
25 *good with the patients, you know, you're more likely to just go in there and take the*
26 *blood rather than actually you know being a doctor to them...so you have to be a lot*
27 *more careful when you're tired I suppose."* (Tel. Int. 9, Foundation)
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34 These issues were sometimes compounded by hunger and discomfort arising from not
35 achieving rest breaks during long shifts.
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39 *"I think when I'm hungry my fuse is shorter and I think my compassion towards others*
40 *is not as what it should be."* (Tel. Int. 2, Foundation)
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45 A summary of the Findings is presented in Table 3 below.
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48
49 **Table 3. Summary of findings**

Overall findings	Detail of findings
Perceived effects of WTR on working hours	General agreement that working hours were much improved under WTR; 48-hour limit appropriate (but desire for greater flexibility); intended benefits achieved to some extent
Implementation of WTR in practice: effects on fatigue	Different shift systems and patterns of work (timing and adjustment). Long periods without a day off. Averaging over 26 weeks can still allow over 48 working hours in one week.

	Work compression/work intensity. Rest periods not always taken.
Drivers to work long hours	Workload/completion of tasks. Taking up educational opportunities at work. Taking work home. Commitment and responsibility to patients and colleagues; collegiality. Cultural expectations. Professional reputation. Views of nature of professionalism. Workforce issues.
Effects of fatigue	Detriment to skills and judgement: most felt to affect efficiency rather than safety. Negative effect on ability to retain new information. Mood and manner (compounded by physical discomfort and hunger)

Discussion

Despite the introduction of restricted working hours for junior doctors in the UK, long hours and fatigue remain, with associated consequences for performance. There was general agreement that restricting working hours was a positive thing, but that problems remained with acute workload in some working patterns. Conversely, while most felt that a 48 hour limit was appropriate, some would like more flexibility to exceed it when necessary.

It was considered that the amount of work to be carried out had not reduced, increasing the perceived intensity of work. Some working patterns were considered particularly intense and detrimental to personal well-being – with consequences for performance and education.

Long periods without a day off in particular were tiring. There is no objective record of hours worked, as WTR compliance is derived from New Deal monitoring reports, and trainees reported no formal measures for health and well-being.

There was evidence that the design of rotas was not the only factor working against well-being. Trainees were often working beyond their rostered hours for voluntary reasons of workload, perceived need to gain educational opportunities, and collegiality, but also for more external reasons such as the expectations of others and gaps in the rota. Notably these are corollaries of the voluntary reasons – rota gaps increase workload, and adverse cultures may define professional practice. Contrary to recent recommendations that ‘every

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3 moment count' towards education in the workplace,⁴² for some trainees at least there is
4 increasing separation between work and education, and an increase in work intensity that
5 may be adding new stresses to the trainee population.
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10 The current study provides evidence that three years after the implementation of the WTR,
11 and with rotas that are at least compliant on paper, fatigue remains an issue for doctors in
12 training. This reflects some findings in the literature that a reduction in working hours alone is
13 not enough. **The issue of increased work intensity and greater stress was noted amongst US**
14 **residents when working hours were further restricted.**⁴³ **Performing the same amount of work**
15 **in fewer hours (work compression) is of concern regarding workload**⁴⁴ **and overall well-**
16 **being,**⁴⁵ **and may place trainee doctors at risk of burnout.**⁴⁶ Although much of the literature
17 relating to fatigue comes from the USA where restricted working hours are still much longer
18 than in Europe (e.g. >24 hour shifts until 2011, or 80-hour weeks), two UK self-report studies
19 conducted shortly after implementation of the 48-hour working week have highlighted the
20 effect of different schedules on fatigue, including the negative effect of working seven
21 consecutive nights, having only one day of rest after night shifts, intervals of less than ten
22 hours between shifts, and shifts of twelve consecutive days.^{30 31} Difficulty achieving naps
23 during night shifts, and poor provision for naps, has been reported elsewhere.³³ The current
24 study has identified that fatigue is related to a number of complex issues, including rota
25 design, but also including contextual issues such as staff shortages and rota gaps, and
26 broader professional and cultural issues.
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46 **Cultural issues within healthcare have been found to include fatigue not being taken**
47 **seriously, lack of discussion of fatigue issues and lack of support for napping.**⁴⁷ **The culture**
48 **of medicine needs to value sleep and appropriate work schedules.**⁴⁸ Long working hours
49 may be a symptom of, and contribute to, an adverse culture. Expectations of long hours,
50 coupled with a lack of their explicit recognition, may be symptomatic of 'institutionalised
51 disrespect' of workers,³⁴ which if it is felt to be normal may lead to further dysfunctional
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3 behaviours. Culture, particularly at the level of basic underlying assumptions that may
4 underpin day-to-day work, can be extremely difficult to change.^{34 49} In a study of paramedics,
5 podiatrists and occupational therapists, the working environment has also been found to be
6 an important factor in encouraging and developing professionalism.⁴⁴⁻⁵⁰ and sSome trainees
7 in the current study felt undermined by aspects of the professional and organisational culture
8 and felt there was a lack of recognition of the extra hours they worked.

9
10
11 In other professions and industries the organisation of work, and the professional and
12 organisational cultures they engender or reinforce (such as a culture of long working hours;
13 cultural attitudes towards napping), has also been linked to fatigue, performance, safety,
14 health and well-being. Such professions and industries include nursing,⁵¹ aviation,⁵² the
15 police,⁵³ truck driving,⁵⁴ the shipping industry⁵⁵ and the construction industry.⁵⁶ It has also
16 been found, in a study of metropolitan train drivers, that the successful adoption of fatigue
17 management strategies can be positively or negatively affected by aspects of the
18 organisational culture, such as altruism and camaraderie.⁵⁷ A culture of denial of vulnerability
19 to stress and the effects of fatigue on performance has been identified in both aviation and
20 medicine,⁵⁸ although one study found this to a lesser extent in aviation.⁵⁹

21
22 Work hours are closely related to psychosocial work characteristics such as work demands
23 and autonomy.⁶⁰ Optimal amount and quality of workload, and opportunities for control at
24 work are among the psychosocial criteria identified for a good work environment and good
25 work organisation, and typically show dependence on national and organisational culture
26 and values,⁶¹ however individual differences in the desire or need for control need to be
27 taken into account.⁶² High work demands and work intensity, and lack of autonomy (and
28 particularly a combination of these) have been associated with health problems.⁶³ In a study
29 of US nurses, high job demands were associated with greater fatigue when job control was
30 low.⁶⁴ Ability to influence working hours (worktime control) has been associated with fewer
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3 subjective health complaints,⁶⁵ and with decreased work strain and decreased perceived
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5 stress.⁶⁶
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9 The broader cultural issues identified in relation to trainees' professional autonomy and the
10 relationship between trainees and their seniors are of current relevance in light of the Francis
11 report's recommendations for fundamental culture change in the NHS.⁴⁵⁶⁷ Following these
12 recommendations, it has been argued that more sophisticated understandings of cultural
13 dynamics and the role of policy in shaping these may be needed.⁴⁶⁶⁸ Fatigue may be an
14 important mediating variable in the perpetuation of adverse cultures and practice failings,
15 and as such should be an important component of any policies to monitor and improve
16 workplace cultures.
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25 Evaluation of the WTR must be considered in relation to the historical context within which
26 they were implemented. Perceptions of the WTR were not isolated from other changes
27 affecting working hours, particularly the 1991 New Deal for Junior Doctors, which imposed
28 restrictions for the first time. At an organisational level, changes relating to the reorganisation
29 of specialty training over the last 20 years⁴⁷⁶⁹ affected the working environment. Trainees
30 now have to settle on a career specialty training path sooner, meaning that the Senior House
31 Officer (SHO) posts they would have filled in other specialties for up to several years may
32 remain unfilled. These gaps are compounded by the reduction in the number of overseas-
33 qualified doctors entering the UK following changes to immigration policy in 2008. The
34 workload and hence fatigue experienced by individual trainees can therefore be seen as the
35 end-point of many contributory factors.
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48 49 **Strengths and limitations**

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51 The strength of the current study is the breadth of trainee participants, covering a range of
52 training grades and specialties and all four nations of the UK, so gaining a picture across the
53 trainee experience. A weakness is that the trainee participants were volunteers to the study,
54 and as such may be open to self-selection bias. However, this risk is mitigated by the
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3 instance of one group, run as part of Foundation Programme teaching, where all but four of
4
5 a cohort of F1s were able to attend. That group identified the same issues as the wider
6
7 sample, suggesting the prevalence of the concerns identified is not limited to a particularly
8
9 engaged sample. **There may also be some instances of inaccuracy in individual recall**
10
11 **regarding the exact hours trainees worked.**

13 **Conclusion**

14
15
16 The WTR have reduced the hours junior doctors work, but have not fully addressed
17
18 problems of fatigue and stress, due to issues in their implementation and other contextual
19
20 factors. The long term risks of this continued stress and fatigue, for the doctors themselves
21
22 and for the effective delivery of a healthcare service, should not be ignored.
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26 Future research could usefully involve an investigation of work intensity and its effects on
27
28 doctors' education, performance and well-being, and its impact on patient care. Such
29
30 research should consider the clinical demands of different specialties and the working
31
32 environment. Policy and practice could consider how best to monitor both working hours and
33
34 doctors' well-being. The closer and more effective involvement of trainees in rota design,
35
36 with consideration of the physiological aspects of sleep and fatigue, may help to avoid some
37
38 stresses, but there may need to be more fundamental consideration of necessary staffing
39
40 levels.
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43 **Acknowledgements**

44
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48 trainee doctors who took part in focus groups or telephone interviews.
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References

1. Morrow G, Burford B, Carter M, *et al.* *The Impact of the Working Time Regulations on medical education and training: Literature review.* Report to the GMC, August 2012.
http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Literature_Review.pdf 51155615.pdf
2. Ayas NT, Barger LK, Cade BE, *et al.* Extended work duration and the risk of self-reported percutaneous injuries in interns. *JAMA* 2006;296:1055-62.
3. Fisman DN, Harris AD, Rubin M, *et al.* Fatigue increases the risk of injury from sharp devices in medical trainees: results from a case-crossover study. *Infect Cont Hosp Ep* 2007;28:10-17.

- 1
- 2
- 3 4. Barger LK, Ayas NT, Cade BE, *et al.* Impact of extended-duration shifts on medical
- 4 errors, adverse events, and attentional failures. *PLOS Med* 2006;3:e487.
- 5
- 6
- 7 5. Gander P, Purnell H, Garden A, *et al.* Work patterns and fatigue-related risk among
- 8 junior doctors. *Occup Environ Med* 2007;64:733-738.
- 9
- 10
- 11 6. Kohen-Raz R, Himmelfarb M, Tzur S, *et al.* An initial evaluation of work fatigue and
- 12 circadian changes as assessed by multiplate posturography. *Percept Motor Skill*
- 13 1996;82:547-557.
- 14
- 15
- 16
- 17 7. Parshuram CS, Dhanani S, Kirsh JA, *et al.* Fellowship training, workload, fatigue and
- 18 physical stress: A prospective observational study. *Can Med Assoc J* 2004;170:965-970.
- 19
- 20
- 21 8. Smith AM, Morris P, Rowell KO, *et al.* Junior doctors and the full shift rota - psychological
- 22 and hormonal changes: a comparative cross-sectional study. *Clin Med* 2006;6:174-177.
- 23
- 24
- 25 9. Block L, Wu AW, Feldman L, *et al.* Residency schedule, burnout and patient care among
- 26 first-year residents. *Postgrad Med J* 2013;89:495-500.
- 27
- 28
- 29 10. Gohar A, Adams A, Gertner E, *et al.* Working memory capacity is decreased in sleep-
- 30 deprived internal medicine residents. *J Clin Sleep Med* 2009;5:191-197.
- 31
- 32
- 33 11. Lockley SW, Cronin JW, Evans EE, *et al.* Effect of reducing interns' weekly work hours
- 34 on sleep and attentional failures. *New Engl J Med* 2004;351:1829-1837.
- 35
- 36
- 37 12. Jakubowicz DM, Price EM, Glassman HJ, *et al.* Effects of a twenty-four hour call period
- 38 on resident performance during simulated endoscopic sinus surgery in an Accreditation
- 39 Council for Graduate Medical Education-compliant training program. *Laryngoscope*
- 40 2005;115:143-146.
- 41
- 42
- 43 13. Gander P, Millar M, Webster C, *et al.* Sleep loss and performance of anaesthesia
- 44 trainees and specialists. *Chronobiol Int* 2008; 25:1077-1091.
- 45
- 46
- 47 14. Brandenberger J, Kahol K, Feinstein AJ, *et al.* Effects of duty hours and time of day on
- 48 surgery resident proficiency. *Am J Surg* 2010;200:814-818.
- 49
- 50
- 51 15. Ellman PI, Law MG, Tache-Leon C, *et al.* Sleep deprivation does not affect operative
- 52 results in cardiac surgery. *AnnThorac Surg* 2004;78:906-911.
- 53
- 54
- 55
- 56
- 57
- 58
- 59
- 60

- 1
2
3 16. Lehmann KS, Martus P, Little-Elk S, *et al.* Impact of sleep deprivation on medium-term
4 psychomotor and cognitive performance of surgeons: prospective cross-over study with
5 a virtual surgery simulator and psychometric tests. *Surgery* 2010;147:246-254.
6
7
8
9 17. Grantcharov TP, Bardram L, Funch-Jensen P, *et al.* Laparoscopic performance after one
10 night on call in a surgical department: prospective study. *Brit Med J* 2001;323:1222-3.
11
12
13 18. Landrigan CP, Rothschild JM, Cronin JW, *et al.* Effects of reducing interns' work hours
14 on serious medical errors in intensive care units. *New Engl J Med* 2004;351:1838-1848.
15
16
17 19. Lockley SW, Landrigan CP, Barger LK, *et al.* Harvard Work Hours, Health Safety Group.
18 When policy meets physiology: the challenge of reducing resident work hours. *Clin*
19 *Orthop Relat R* 2006;449:16-127.
20
21
22 20. Majekodunmi A, Landrigan CP. The effect of physician sleep deprivation on patient
23 safety in perinatal-neonatal medicine. *Am J Perinat* 2012;29:43-48.
24
25
26 21. Vorona RD, Chen IA, Ware JC. Physicians and sleep deprivation. *Sleep Medicine Clinics*
27 2009;4:527-540.
28
29
30 22. Paice E, Hamilton-Fairley D. Avoiding burnout in new doctors: sleep, supervision and
31 teams. *Postgrad Med J* 2013;89:493.
32
33
34 23. Sokol DK. Waking up to the effects of fatigue in doctors. *Brit Med J* 2013;347:f4906
35
36
37 24. Conigliaro J, Frishman WH, Lazar EJ, *et al.* Internal medicine housestaff and attending
38 physician perceptions of the impact of the New York State Section 405 regulations on
39 working conditions and supervision of residents in two training programs. *J Gen Intern*
40 *Med* 1993; 8:502-507.
41
42
43 25. Kort KC, Pavone LA, Jensen E, *et al.* Resident perceptions of the impact of work-hour
44 restrictions on health care delivery and surgical education: time for transformational
45 change. *Surgery* 2004;136:861-871.
46
47
48 26. Kiernan M, Civetta J, Bartus C, *et al.* 24 hours on-call and acute fatigue no longer
49 worsen resident mood under the 80-hour work week regulations. *Curr Surg* 2006;63:237-
50 241.
51
52
53
54
55
56
57
58
59
60

- 1
2
3 27. Cull WL, Mulvey HJ, Jewett EA, *et al.* Pediatric residency duty hours before and after
4 limitations. *Pediatrics* 2006;118:e1805-1811.
5
6
7 28. Reddy R, Guntupalli K, Alapat P, *et al.* Sleepiness in medical ICU residents. *Chest*
8 2009;135:81-85.
9
10
11 29. Berios I, Surani S, Simmons M. Assessing reaction time among emergency medicine
12 residents working different shift hours. *Ann Emerg Med* 2009; 54: S35.
13
14
15 30. Brown M, Tucker P, Rapport F, *et al.* The impact of shift patterns on junior doctors'
16 perceptions of fatigue, training, work/life balance and the role of social support. *Qual Saf*
17 *Health Care* 2010;19:e36.
18
19
20
21 31. Tucker P, Brown M, Dahlgren A, *et al.* The impact of junior doctors' worktime
22 arrangements on their fatigue and well-being. *Scand J Work Env Hea* 2010;36:458-46
23
24
25 32. Arora V, Dunphy C, Chang VY, *et al.* The effects of on-duty napping on intern sleep time
26 and fatigue. *Ann Intern Med* 2006;144:792-798.
27
28
29
30 33. Jackson EJ, Moreton A. Safety during night shifts: a cross-sectional survey of junior
31 doctors' preparation and practice. *BMJ Open* 2013 3: doi: 10.1136/bmjopen-2013-
32 003567.
33
34
35 34. Leape LL, Shore MF, Dienstag JL, *et al.* A culture of disrespect, Part 1: The nature and
36 causes of disrespectful behavior by physicians. *Acad Med* 2012;87:845-852.
37
38
39 35. O'Gallagher MK, Lewis G, Mercieca K, *et al.* The impact of the European Working Time
40 Regulations on Ophthalmic Specialist Training - A national trainee survey. *Int J Surg*
41 2013: <http://dx.doi.org/10.1016/j.ijsu.2013.08.007>
42
43
44
45 36. Illing JC, Carter M, Thompson NJ, *et al.* *Evidence synthesis on the occurrence, causes,*
46 *consequences, prevention and management of bullying and harassing behaviours to*
47 *inform decision making in the NHS. Final report.* NIHR Service Delivery and Organisation
48 programme; 2013.
49
50
51
52
53 37. Williams ES, Konrad TR, Scheckler WE, *et al.* Understanding physicians' intentions to
54 withdraw from practice: the role of job satisfaction, job stress, mental and physical
55 health. *AHCM* 2001;2:243-262.
56
57
58
59
60

- 1
2
3 38. Edwards N, Kornacki MJ, Silversin J. Unhappy doctors: what are the causes and what
4 can be done? *Brit Med J* 2002;324:835-8.
5
6
7 39. Visser MRM, Smets EMA, Oort FJ, *et al.* Stress, satisfaction and burnout among Dutch
8 medical specialists. *CMAJ* 2003;168:271-5.
9
10
11 40. Morrow G, Burford B, Carter M, *et al.* *The Impact of the Working Time Regulations on*
12 *medical education and training: Final report on primary research.* Report to the GMC,
13 August 2012. [http://www.gmc-](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf_51157039.pdf)
14 [uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Tr](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf_51157039.pdf)
15 [aining_Final_Report_on_Primary_Research.pdf_51157039.pdf](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf_51157039.pdf)
16
17
18
19
20
21 41. Ritchie J, Spencer L. Qualitative data analysis for applied policy research. In: Bryman A,
22 Burgess RG, editors. *Analysing Qualitative Data.* London: Routledge; 1994. p.173-194.
23
24
25 42. Temple J. Time for Training: A review of the impact of the European Working Time
26 Directive on the quality of training. 2010.
27
28 http://www.mee.nhs.uk/pdf/JCEWTD_Final%20report.pdf
29
30
31 43. Auger KA, Sieplinga KR, Simmons JM, *et al.* Failure to thrive: Pediatric residents weigh
32 in on feasibility trial of the proposed 2008 Institute of Medicine work hour restrictions. *J*
33 *Grad Med Educ* 2009;1:181-184.
34
35
36
37 44. Goitein L. Resident workload – Let's treat the disease, not just the symptom. *JAMA*
38 *Intern Med* 2013;173:655-656.
39
40
41 45. Auger KA, Landrigan CP, Gonzalez del Ray JA, *et al.* Better rested but more stressed?
42 Evidence of the effects of resident work hour restrictions. *Acad Pediatr* 2012;12:335-343.
43
44
45
46 46. Wayne DB, Arora V. Resident duty hours and the delicate balance between education
47 and patient care. *J Gen Intern Med* 2008;23:1120-1121.
48
49
50 47. Ferguson SA, Neall A, Dorrian J. Strategies used by healthcare practitioners to manage
51 fatigue-related risk: beyond work hours. *Medical Sociology online* 2013;7:24-33.
52 <http://www.medsoconline.org/>
53
54
55
56 48. Buysse DJ, Barzansky B, Dinges D, *et al.* Sleep, fatigue, and medical training: setting an
57 agenda for optimal learning and patient care. A report from the Conference "Sleep,
58
59
60

1
2
3 fatigue and medical training: Optimizing learning and the patient care environment".

4
5 *Sleep* 2003;2:218-225.

6
7 49. Schein EH. Organisational culture and leadership. 4th edn. Jossey-Bass, 2010.

8
9 50. Morrow G, Burford B, Rothwell C, *et al.* Carter M, McLachlan J, Illing J. *Professionalism*
10 *in healthcare professionals. Perceptions of professionalism.* Final report to the hpc,
11 2011. [http://www.hpc-](http://www.hpc-uk.org/assets/documents/10003771Professionalisminhealthcareprofessionals.pdf)
12 [uk.org/assets/documents/10003771Professionalisminhealthcareprofessionals.pdf](http://www.hpc-uk.org/assets/documents/10003771Professionalisminhealthcareprofessionals.pdf)
13
14

15
16 51. Rogers AE. The effects of fatigue and sleepiness on nurse performance and patient
17 safety. In: Hughes RG. editor. *Patient safety and quality: An evidence-based handbook*
18 *for nurses.* Rockville (MD): Agency for Healthcare Research and Quality (US); 2008.p2-
19 509-2-533.
20
21

22
23 52. Gregory KB, Winn W, Johnson K, *et al.* Pilot fatigue survey: Exploring fatigue factors in
24 air medical operations. *Air Med J* 2010;29:309-319.
25
26

27
28 53. Vila B. Impact of long work hours on police officers and the communities they serve. *Am*
29 *J Ind Med* 2006;49:972-980.
30
31

32
33 54. Sabbagh-Ehrlich S, Friedman L, Richter E. Working conditions and fatigue in
34 professional truck drivers at Israeli ports. *Inj Prev* 2005;11:110-114.
35
36

37
38 55. Xhellilaj E, Lapa K. The role of human fatigue factor towards maritime casualties.
39 *Maritime Transport & Navigation Journal* 2010;2:23-32.
40
41

42
43 56. Dong X. Long workhours, work scheduling and work-related injuries among construction
44 workers in the United States. *Scand J Work Environ Health* 2005;31:329-335.
45
46

47
48 57. Rainbird S, Thompson K, Dawson D. The impact of organisational culture on fatigue
49 management: The case of camaraderie amongst metropolitan train drivers. In: Sargent
50 C, Darwent D, Roach GD. editors. *Living in a 24/7 world: The impact of circadian*
51 *disruption on sleep, work and health.* Adelaide: Australasian Chronobiology Society;
52 2010.p.29-33.
53
54

55
56 58. Helmreich RL. On error management: lessons from aviation. *Brit Med J* 2000;320:781-
57 785.
58
59
60

- 1
2
3 59. Sexton JB, Thomas EJ, Helmreich RL. Error, stress and teamwork in medicine and
4 aviation: cross sectional surveys. *Brit Med J* 2000;320:745-749.
5
6
7 60. Härmä M. Workhours in relation to work stress, recovery and health. *Scand J Work*
8 *Environ Health* 2006;32:502-514.
9
10
11 61. Lindström K. Psychosocial criteria for good work organization. *Scand J Work Environ*
12 *Health* 1994;20:123-133.
13
14
15 62. Sparks K, Faragher B, Cooper CL. Well-being and occupational health in the 21st
16 century workplace. *J Occup Organ Psych* 2001;74:489-509.
17
18
19 63. Eurofound. Fifth European working conditions survey. Publications Office of the
20 European Union, Luxembourg, 2012.
21
22 <http://www.eurofound.europa.eu/pubdocs/2011/82/en/1/EF1182EN.pdf>
23
24
25 64. Van Yperen NW, Hagedoorn M. Do high job demands increase intrinsic motivation or
26 fatigue or both? The role of job control and job social support. *Acad Manage J*
27 2003;46:339-348.
28
29
30
31 65. Costa G, Akerstedt T, Nachreiner F, et al. Flexible working hours, health, and well-being
32 in Europe: some considerations from a SALTSA project. *Chronobiol Int* 2004;21:831-
33 844.
34
35
36
37 66. Kandolin I, Huida O. Individual flexibility: an essential pre-requisite in arranging shift
38 schedules for midwives. *J Nurs Manag* 1996;4:213-217.
39
40
41
42 67. Francis R. *Report of the Mid Staffordshire NHS Foundation Trust public inquiry*.
43 Stationery Office, 2013.
44
45
46 68. Davies H, Mannion R. Will prescriptions for cultural change improve the NHS? *Brit Med J*
47 2013;346:f1305.
48
49
50 69. HMSO. Hospital Doctors: Training for the future. The report of the working group on
51 specialist medical training. HMSO, 1993.
52
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Have restricted working hours reduced junior doctors' experience of fatigue? A focus group and telephone interview study

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4 **Have restricted working hours reduced junior doctors' experience of fatigue? A focus**
5 **group and telephone interview study**
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ABSTRACT

Objective To explore the effects of the UK Working Time Regulations (WTR) on trainee doctors' experience of fatigue.

Design Qualitative study involving focus groups and telephone interviews, conducted in Spring 2012 with doctors purposively selected from Foundation and specialty training. Final compliance with a 48 hour per week limit had been required for trainee doctors since August 2009. Framework analysis of data.

Setting Nine deaneries in all four UK nations; secondary care.

Participants 82 doctors: 53 Foundation trainees and 29 specialty trainees. Thirty-six participants were male, 46 female. Specialty trainees were from a wide range of medical and surgical specialties, and psychiatry.

Results Implementation of the WTR, whilst acknowledged as an improvement to the earlier situation of prolonged excessive hours, has not wholly overcome experience of long working hours and fatigue. Fatigue did not only arise from the hours that were scheduled, but also from an unpredictable mixture of shifts, work intensity (which often resulted in educational tasks being taken home), and inadequate rest. Fatigue was also caused by trainees working beyond their scheduled hours, for reasons such as task completion, accessing additional educational opportunities beyond scheduled hours, and staffing shortages. There were also organisational, professional and cultural drivers, such as a sense of responsibility to patients and colleagues and the expectations of seniors. Fatigue was perceived to affect efficiency of skills and judgement, mood, and learning capacity.

Conclusions Long-term risks of continued stress and fatigue, for doctors and for the effective delivery of a healthcare service, should not be ignored. Current monitoring processes do not reflect doctors' true working patterns. The effectiveness of the WTR cannot be considered in isolation from the culture and context of the workplace. On-going attention

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3 needs to be paid to broader cultural issues, including the relationship between trainees and
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ARTICLE SUMMARY

Article focus

The aim of the paper is to explore the effects of the UK Working Time Regulations (WTR) on trainee doctors' experience of fatigue.

Key messages

- The implementation of the WTR, whilst acknowledged to be an improvement to the earlier situation of prolonged excessive hours, has not wholly overcome experience of long working hours and fatigue. Reasons for persistent fatigue include the organisation of working patterns, work compression and intensity - thus also taking more work home – and working longer than rostered hours. This was related to taking up extra educational opportunities at work and to professional and organisational culture, including trainees' sense of responsibility towards patients and colleagues and the expectations of seniors. Current monitoring processes do not reflect doctors' true working patterns.lack sensitivity to issues regarding rotas and hours worked.
- Effects on fatigue and on education cannot be isolated from other contextual factors, including workforce issues.
- On-going attention needs to be paid to broader cultural issues identified in relation to expectations placed on trainees and the relationship between trainees and their seniors.

Strengths and limitations

- The strength of the study is the breadth of trainee participants, covering a range of training grades and specialties and all four nations of the UK.
- A potential weakness is that participants were volunteers to the study, and as such may be open to self-selection bias. However, this risk is mitigated by the instance of one group run as part of Foundation Programme teaching, where all but four of a cohort of Foundation Year One trainees (F1s) were able to attend. That group

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3 identified the same issues as the wider sample, suggesting the prevalence of the
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5 issues identified is not limited to a particularly engaged sample. There may also be
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7 potential inaccuracies in individual recall of hours worked.
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3 **Title: Have restricted working hours reduced junior doctors' experience of fatigue? A**
4 **focus group and telephone interview study**
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8 **Introduction**
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12 There is a considerable body of evidence recognising that fatigue has adverse physiological,
13 psychological and cognitive effects and can lead to deficits in performance and safety.¹

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15 Fatigue in doctors is associated with increases of in risks to personal safety at work^{2 3} and
16 outside work,^{4 5} and risks to health and well-being.⁶⁻⁹ There is also evidence of detriments to
17 performance, for example in cognitive abilities^{10 11} and psychomotor skills¹²⁻¹⁴ (although
18 some studies have found no performance effects^{15 16}). Fatigue has also been associated
19 directly with negative consequences for patient safety such as clinical errors and diagnostic
20 mistakes.^{4 5 17-20} This has been a concern in medicine for several years²¹ and remains so
21 today.^{22 23} The effects may be compounded by a risk that doctors do not recognise that they
22 may be subject to adverse effects.²³
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34 Several countries have introduced limits on working hours. For example, in the USA, since
35 2003, there has been national implementation of an Accreditation Council for Graduate
36 Medical Education (ACGME) 80-hour resident work week restriction, averaged over four
37 weeks; however the limit is lower in Europe. The European Working Time Directive (EWTD)
38 was introduced to limit hours, to address health and safety concerns for all workers arising
39 from long hours. Each European Union member state implemented the Directive in its own
40 legislation – the UK as the Working Time Regulations (1998). These Regulations (the WTR)
41 have applied fully to junior doctors since 2009, with a limit of 48 hours per week, averaged
42 across a reference period of 26 weeks, alongside specified minimum rest periods. The WTR
43 are implemented in rotas (work schedules) alongside the New Deal, which specifies a
44 maximum of 56 hours per week, with a system of banded payments.
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3 Positive effects of a reduction in working hours have been found in many studies,²⁴⁻²⁶ but not
4 all.^{27 28} The effect varies with the precise implementation of restrictions, with fatigue affected
5 by work patterns including the number of consecutive days or nights worked, the intervals
6 between shifts, and the timing of shifts (day/evening/night).²⁹⁻³¹ Short naps may ameliorate
7 the negative effects of fatigue,³² and awareness of the benefits of naps and other
8 recommendations and interventions to limit fatigue associated with rotating shift work may
9 be needed.³³

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18 Organisational cultures of long or antisocial hours³⁴ may also be a factor impacting on stress
19 and fatigue, and trainees have reported being unofficially expected to work extra hours
20 voluntarily.³⁵ Furthermore workload pressures and poor work design may increase risks of
21 negative behaviours among staff.³⁶ Limits on professional autonomy – the amount of control
22 doctors have traditionally held over their practice – may also increase doctors' stress and
23 reduce job satisfaction.³⁷⁻³⁹

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32 Consequently, simply restricting the number of work hours may be insufficient to address
33 issues relating to fatigue and its consequences. With this in mind, the question is raised
34 whether the WTR will have achieved the aim of improving junior doctors' well-being and
35 fatigue. To date, there has been little research looking directly at the effects of the WTR as
36 implemented and experienced in practice. This paper draws on a larger research study
37 considering perceptions of the effects of the WTR,⁴⁰ and focuses specifically on their effects
38 on trainee doctors' fatigue.

47 48 **Method**

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51 The research was reviewed by the Durham University School of Medicine, Pharmacy and
52 Health Ethics Sub-Committee, and a favourable ethical opinion received.

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56 Focus groups and telephone interviews (with participants who were unable to attend a focus
57 group) were conducted with Foundation Year One (FY1) and Foundation Year Two (FY2)

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3 trainees and specialty trainees, sampled purposively from nine deaneries in all four nations
4 of the UK. The Foundation Programme is a two-year generic training programme undertaken
5 after completing medical school, and is followed by specialist or general practice training.
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9 The WTR apply to all years of training in the same way.
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12 The focus group topic guide and interview questions focused on perceptions and experience
13 of working hours following the WTR and any educational or personal impact. Trainees were
14 asked about their knowledge of the WTR; their perceptions of their working hours in practice,
15 including shifts, rotas and compliance; issues concerning educational opportunities;
16 monitoring of working hours, and any personal effects they experienced. Some specialty
17 trainees had experience of working before the introduction of the WTR, and were asked
18 about the change.
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27 Recruitment was undertaken following local advice; in some cases through the Deanery, in
28 others through education centres in individual hospitals. An information sheet about the
29 study was distributed to trainees via email from the Deaneries or individual Trusts, and
30 participation was on a voluntary basis. Written consent was taken at the start of focus groups
31 and verbal consent at the start of telephone interviews, including consent for audio
32 recording. Recordings were later transcribed. GM and BB conducted the focus groups and
33 telephone interviews. Focus groups lasted between 60 and 90 minutes, and telephone
34 interviews between 30 and 45 minutes.
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45 **Analysis**

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47 Data were analysed using a framework approach.⁴¹ An initial stage of familiarisation, to gain
48 an overall view of the data, involved reading the transcripts and noting the range and depth
49 in the data collected. Meetings between all four researchers engaged in this process (GM,
50 BB, MC, JI) enabled discussion of the concepts and themes that emerged from the data. A
51 thematic framework was subsequently identified by GM and BB. This involved identifying the
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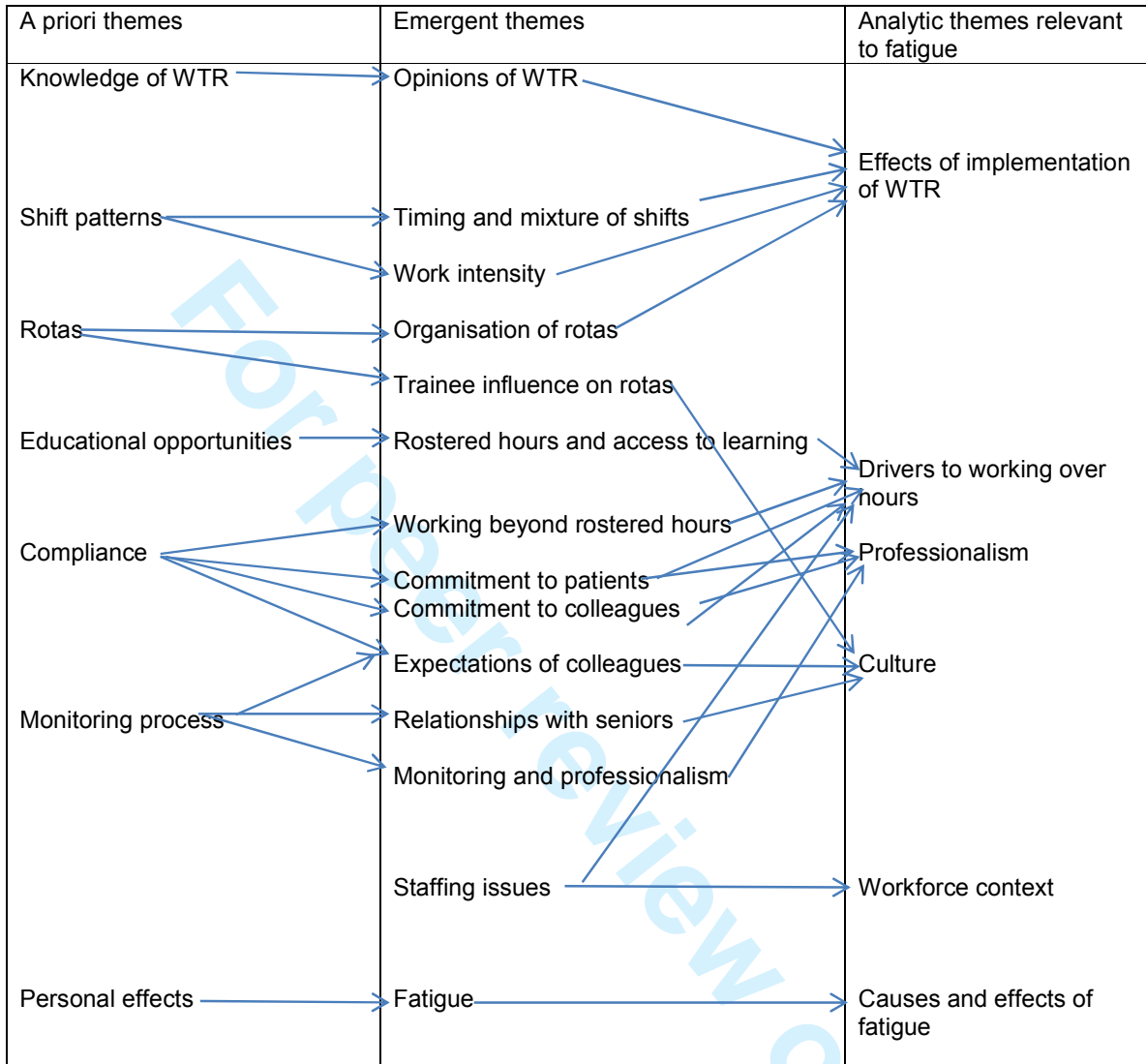
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3 key issues, concepts or themes by which the data could be examined and sorted. The
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5 construction of the framework drew upon:

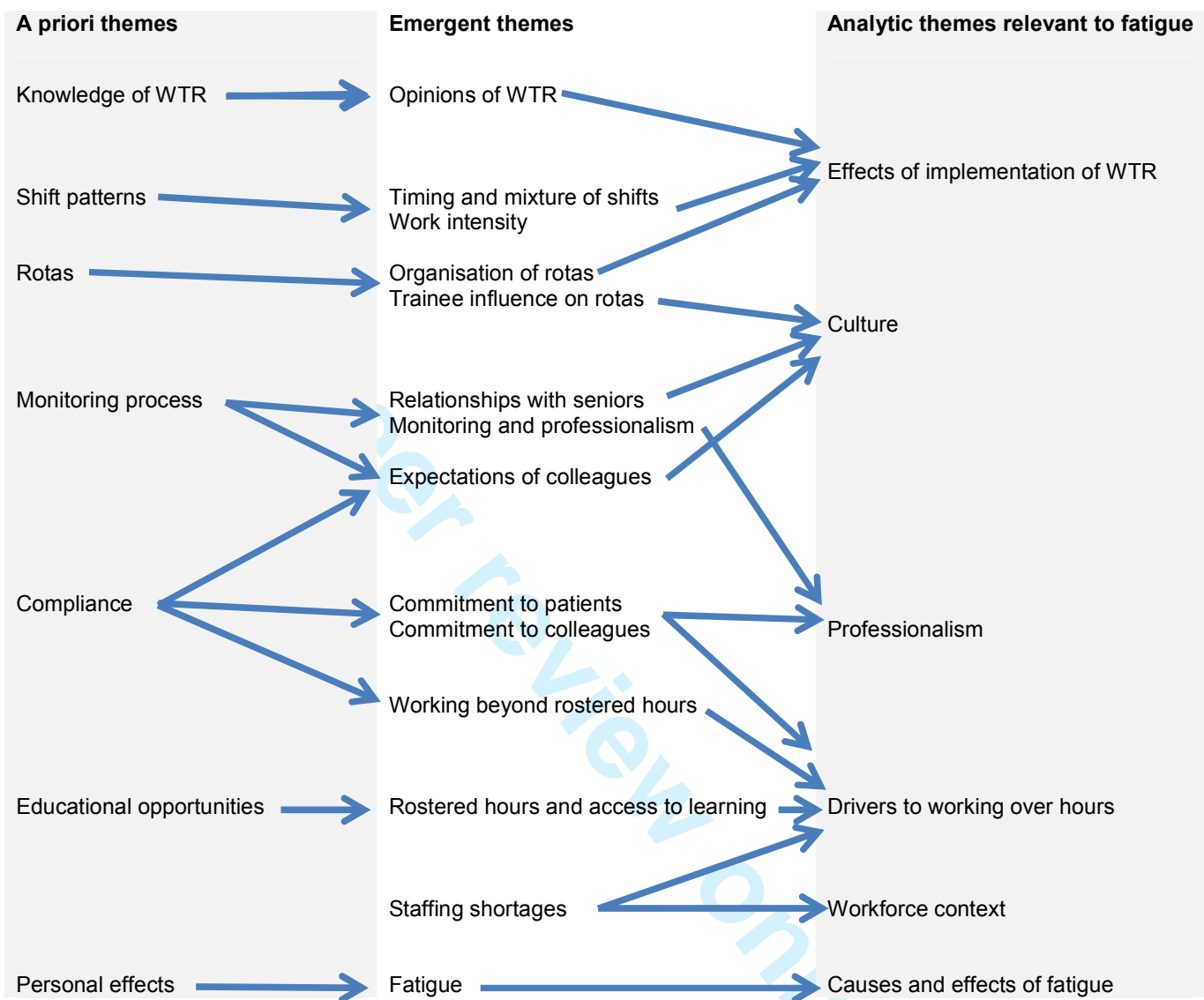
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- 8 • *a priori* issues - those issues that were known or assumed to be pertinent, that guided
9 the study aims and were developed into the topic guide/interview schedule;
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- 12 • *emergent* issues - those issues that were raised by the respondents (e.g. issues relating
13 to work intensity);
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- 16 • *analytic* issues - those themes that emerged from patterns and re-occurrences in the
17 data (e.g. professionalism)
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22 The framework was then applied to the data by GM and BB through indexing and charting,
23 and themes and sub-themes were further refined. Finally, a stage of mapping and
24 interpretation involved bringing the key themes within the data set together and pulling
25 together the findings of the analysis as a whole. Table 1 summarises the main *a priori*
26 themes, emergent themes, and analytic themes related to fatigue and illustrates the mapping
27 and interpretation of the themes. The process of analysis helped provide an explanation of
28 why fatigue remains an issue, and of the inter-relatedness of the issues identified.

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38 Data from focus groups and telephone interviews were analysed concurrently and no
39 differences in themes were identified.
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Table 1. Development of themes in framework analysis





Findings

Eleven focus groups and 30 telephone interviews were conducted with 82 junior doctors.

See Table 2 for details of the training grades of participants.

Table 2. Training grades of participants

Foundation Year 1 (FY1)	Foundation Year 2 (FY2)	Core or specialty training up to CT/ST3*	ST4 or higher **
40	13	7	22
Total Foundation trainees: 53		Total specialty trainees: 29	

* These are trainees in the first three years of their specialty training, and were likely to have started specialty training after the WTR introduction in 2009.

** These are in higher specialty training, in their fourth year or above.

Thirty-six participants were male and 46 were female. Specialty trainee participants were training in a wide range of medical and surgical specialties, and psychiatry.

An overview summary of the Findings from the data is presented in Table 3 below.

Table 3. Summary Overview of findings

Overall findings	Detail of findings
Perceived effects of WTR on working hours	General agreement that working hours were much improved under WTR; 48-hour limit appropriate (but desire for greater flexibility); intended benefits achieved to some extent
Implementation of WTR in practice: effects on fatigue	Different shift systems and patterns of work (timing and adjustment). Long periods without a day off. Averaging over 26 weeks can still allow over 48 working hours in one week. Work compression/work intensity. Rest periods not always taken.
Drivers to work long hours	Workload/completion of tasks. Taking up educational opportunities at work. Taking work home. Commitment and responsibility to patients and colleagues; collegiality. Cultural expectations. Professional reputation. Views of nature of professionalism. Workforce issues.
Effects of fatigue	Detriment to skills and judgement: most felt to affect efficiency rather than safety. Negative effect on ability to retain new information. Mood and manner (compounded by physical discomfort and hunger)

Perceived effects of WTR on working hours

There was general agreement that working hours were much improved under the WTR, and that intended benefits in terms of reduced trainee fatigue and improved work-life balance had been achieved to some extent. Many trainees felt that the 48-hour limit was appropriate and enabled sufficient training experience, albeit with a perceived lack of flexibility.

“I think, speaking to people who didn’t have the forty-eight hour working time directive thing, we get a lot more time to go home and enjoy ourselves and be outside the hospital than they ever did and I think that’s a good thing, I feel like I’ve got a bit more of a life.” (Tel. Int. 22, Foundation)

Implementation of WTR in practice: effects on fatigue

However, some participants did report still working long hours and experiencing fatigue despite the 48-hour limit and this was found to be related to a number of factors including the way in which the Regulations were implemented and other organisational and contextual factors.

The WTR have not entirely eliminated long hours, with some trainees giving examples of working up to 100 hours in a week. However, fatigue did not necessarily arise just from the long hours worked, but also the organisation of work within those hours, for example the mixture of day and night shifts, and long shifts straddling day and night (e.g. 2.00pm to 2.00am). Rotas could involve five consecutive days at work with 13-hour shifts, and working up to 12 consecutive days or, for some, seven consecutive nights (despite Royal College recommendations to the contrary). Trainees reported that averaging meant that a working week could exceed 70 hours and remain compliant.

“I don’t think the hours are long, so doing a 12 hour day or 13 hour day is fine, I think doing 12 days in a row you hit delirium about day ten and then you over-ride it...so I

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3 *don't think it's the shift I think it's the number of days you work in a row.*" (Focus
4 group 3, Foundation)

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8 *"There's no continuity in terms of predictability of, right this is what I'm doing and, for*
9 *example, my rota you run an eight cycle rota so you've got eight weeks to get*
10 *through and none of those eight weeks are the same at all, and you jump around with*
11 *longs and lates in-between and I think that from my side is what creates fatigue."*

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15 (Focus group 10, Specialty)

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20 *"That was a particularly difficult shift on the assessment suite because you would go*
21 *from five long days with maybe two days off, or a day off sometimes, and then onto a*
22 *period of nights, you are constantly swapping from nights to days which was tiring,*
23 *and 12 hour shifts and 13 hour shifts were always a bit of a drag."* (Tel. Int. 22,

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28 Foundation)

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31 There was also a perception that twelve-hour shifts were more fatiguing, with less 'down-
32 time' than longer but less intense on-call sessions. Work intensity was also increased by
33 rotas involving cross-cover out of hours.

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39 *"My personal opinion is [the WTR have] actually increased fatigue and stress in the*
40 *fact that you feel you have to get an increased amount of work done in a shorter*
41 *amount of time."* (Tel. Int. 16, Foundation)

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46 Provision of facilities for taking rest during a night shift was also being reduced which,
47 alongside less capacity to take breaks or compensatory rest, added to the fatigue
48 experienced. Rest periods were also lost in half days – sometimes inserted into rotas to
49 balance hours – not always being taken, sometimes because senior clinical staff were
50 unaware of them, so workload did not respond to working hours.
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3 *“The trouble with night shift is being able to sleep during the day and most hospitals*
4 *have no facility to actually catch a nap while on nights. The last time I worked in a*
5 *hospital with bedrooms for on-call staff was in 2007 and that’s despite guidance from*
6 *the Royal College of Physicians that it should be possible for someone to have a*
7 *short nap.”* (Tel. Int. 23, Specialty)

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14 *“The difficulty is you may be entitled to various half days but the chances of them*
15 *actually materialising are very slight...unless these things are really formalised and*
16 *recognised they just don’t happen. I mean you can just about get your half day off*
17 *before nights because everyone understands that you’re about to start nights...but*
18 *the rest of them just don’t happen.”* (Tel. Int. 19, Foundation)

24 **Drivers to work long hours**

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30 Fatigue did not just arise from hours specified in rota design. There were many reasons,
31 including some voluntary, for trainees working beyond their rostered (scheduled) hours.

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35 Some reasons for working longer hours than scheduled stemmed from the capacity to fit
36 workload into the working period. This was more evident in shift work, where there was a
37 feeling that incoming doctors in the evening may not have the capacity to perform non-
38 urgent tasks, so the present doctor would finish those tasks before leaving. In contrast, in
39 on-call rotas a trainee would simply pass the bleep to the incoming doctor and so have a
40 cleaner handover.
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49 *“You kind of know yourself if I was to leave this work it’s only going to be there for me*
50 *in the morning and there’s a ward round in the morning, so I will have to get loads*
51 *more work handed my way. So you want to get things finished.”* (Tel. Int. 2,
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3 Other drivers came from missing educational opportunities if trainees did not attend work
4 outside the rota, including going to work on rostered days off. These opportunities included
5 attending ward rounds and observing in theatre. While benefits of the WTR for work-life
6 balance were perceived, there was a sense that some educational activity that had been part
7 of the 'work' domain was now being taken home. This included portfolio completion and
8 reading that may have been done in the workplace during slack periods on-call.
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17 *"If you haven't got enough time to eat or go to the toilet, you can't leave work on time,*
18 *then you definitely don't have time to go to clinics, you definitely don't have time to do*
19 *audits or anything like that during work, it basically means that anything that is*
20 *exclusively for your own training is basically done in your own time and the amount of*
21 *time available to you is really diminished."* (Tel. Int. 7, Specialty)
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28 Although this increased their working hours and reduced time for rest and recuperation, the
29 benefit of taking up such opportunities was often seen to outweigh this.
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34 *"I've got no problems with the fact that I work a little bit over and take the extra time*
35 *to get training opportunities and that increases my hours to get better at my job.*
36 *That's personal sacrifice, personal advancement type stuff to get a better job to*
37 *become a consultant."* (Focus group 11, Specialty)
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43 There were also professional and cultural reasons for working beyond rostered hours. These
44 related to the expectations and norms perceived among their professional group and the
45 workplace. Trainee doctors often worked beyond rostered hours due to a sense of
46 commitment and responsibility, both to patients and to colleagues. There were cases of
47 trainees staying late to hand over the care of a patient, rather than force two handovers (for
48 example where a junior doctor would stay to complete an admission in A&E, rather than
49 hand over to another FY2 doctor, who would then have to hand over to the specialty where
50 the patient was being admitted), due to concern for continuity of care and the risk of
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3 information being lost. There was also a strong sense of collegiality, expressed as a
4 responsibility not to burden colleagues with routine tasks particularly as they were likely to
5 face other immediate demands at the handover time.
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11 *“We have just never taken the half days because we’re so busy, you know; we could*
12 *have done, but would have screwed over our colleagues.”* (Focus group 2,
13 Foundation)
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18 At times, however, this could be perceived as a cultural expectation that some jobs would
19 not be left – so less a choice, more an imposition. There were references to a negative
20 culture where trainees could experience pressure from senior doctors, and other
21 professions, to stay beyond their rostered hours, with implication of unprofessionalism if they
22 left on time. There was also a perception amongst trainees that their professional reputation
23 was at risk, with implications for an employment reference and future career.
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31 Concerns about working hours were often not recognised or appreciated by seniors, with
32 some respondents identifying a dismissive attitude towards the WTR, and a feeling that such
33 limitations were counter to medical professionalism. Some trainees also agreed that limited
34 hours undermined professional autonomy, a feeling exacerbated if hours were enforced
35 during the periodic two-week monitoring process.
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43 *“If you clicked that you started at 8.00 and you were meant to start at 9.00, you had*
44 *to explain...why did you do it, so quite a lot of the time I wouldn’t put down that I*
45 *started before 9.00 because I knew I was going to have to justify that I came in*
46 *before 9.00.”* (Focus group 5, Foundation)
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53 Trainees reported that, as WTR compliance is derived from these New Deal monitoring
54 reports, there was no objective record of hours worked, and there were also no formal
55 measures for health and well-being. However, few trainees kept their own record of hours
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3 worked despite their being conscious of working beyond rostered hours. This was partly due
4 to their view of medicine and the nature of their work, meaning that working to limited hours
5 was not an issue to them.
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10 *“We are treated usually like we are working late due to our own failings which is not a*
11 *nice atmosphere to work in, I think it’s very important that you feel you are working,*
12 *especially as a junior in a new career, you’re working somewhere you are*
13 *appreciated, valued and not being looked at suspiciously.”* (Tel. Int. 21, Foundation)
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20 Gaps in rotas also placed additional pressure on the system, and so on individual doctors.
21 These arose from staff shortages caused by under-recruitment, as well as absences. This
22 often meant providing informal cover, for example in extended shifts. While locums were
23 used, external locums were felt to be sometimes unreliable, meaning last minute cover was
24 often necessary. Formal internal locum shifts were sometimes used, and cross-referenced
25 against rotas to ensure an individual did not exceed WTR hours, and there was no reported
26 pressure to undertake locum shifts. The trainees reported that there was a shortage of
27 available doctors to fill rotas, even without the need to comply with the WTR. Some trainees
28 felt that even fully staffed rotas would be stretched because the workload had increased
29 since the staffing levels were initially put in place.
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42 *“The fundamental issue is trying to do a decent job and you can’t do a decent job if*
43 *there aren’t enough of you on the ground, so you are always working many hours in*
44 *excess of what you should be doing, you end up tired and exhausted and jaded and*
45 *then you’re not doing a good job for your patient.”* (Tel. Int. 29, Foundation)
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51 **Effects of fatigue**

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54 Trainees identified effects of fatigue arising from their working hours. While detriments to
55 their skills and judgement were identified, these were mostly felt to affect efficiency rather
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3 than safety – however risks to patient safety cannot be discounted. Some reported that
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5 fatigue affected their ability to retain new information.
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8 *“I think when you were getting to the end of a thirteen hour shift you found that your*
9 *technical skills, like your ability to put a cannula into someone and stuff like that, it*
10 *certainly decreases, I find it gets a lot harder to do things that require more*
11 *concentration, things like that, but I think you’re also quite aware of that, so patient*
12 *safety wise you are aware that you are not at your best so you often check more of*
13 *your decisions with other people and things like that.”* (Tel. Int. 22, Foundation)
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18 *“I think 12 days in a stretch is too long without a day off, I just think it’s a really long*
19 *stretch...I think [the effect] is fatigue really and I suppose you learn less towards the*
20 *end of those days really because you are just tired.”* (Tel. Int. 26, Foundation)
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28 Fatigue was also reported to affect mood, particularly when switching between different
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30 working patterns, with consequences for their professional manner. This may have
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32 consequences for team-working and interprofessional communication, as well as for
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34 interactions with patients.
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37 *“You become more irritable sometimes as well, I noticed I was a bit more snappy*
38 *[when switching between long days and nights]* (Focus group 5, Foundation)
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42 *“You don’t make as good decisions and you’re more grumpy, you’re less likely to be*
43 *good with the patients, you know, you’re more likely to just go in there and take the*
44 *blood rather than actually you know being a doctor to them...so you have to be a lot*
45 *more careful when you’re tired I suppose.”* (Tel. Int. 9, Foundation)
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52 These issues were sometimes compounded by hunger and discomfort arising from not
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54 achieving rest breaks during long shifts.
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3 *"I think when I'm hungry my fuse is shorter and I think my compassion towards others*
4 *is not as what it should be."* (Tel. Int. 2, Foundation)
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8 A summary of the Findings is presented in Table 3 below.
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12 Table 3. Summary of findings
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Overall findings	Detail of findings
Perceived effects of WTR on working hours	General agreement that working hours were much improved under WTR; 48-hour limit appropriate (but desire for greater flexibility); intended benefits achieved to some extent
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Effects of fatigue	Detriment to skills and judgement: most felt to affect efficiency rather than safety. Negative effect on ability to retain new information. Mood and manner (compounded by physical discomfort and hunger)

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39 **Discussion**
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41 Despite the introduction of restricted working hours for junior doctors in the UK, long hours
42 and fatigue remain, with associated consequences for performance. There was general
43 agreement that restricting working hours was a positive thing, but that problems remained
44 with acute workload in some working patterns. Conversely, while most felt that a 48 hour
45 limit was appropriate, some would like more flexibility to exceed it when necessary.
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53 It was considered that the amount of work to be carried out had not reduced, increasing the
54 perceived intensity of work. Some working patterns were considered particularly intense and
55 detrimental to personal well-being – with consequences for performance and education.
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3 Long periods without a day off in particular were tiring. There is no objective record of hours
4 worked, as WTR compliance is derived from New Deal monitoring reports, and trainees
5 reported no formal measures for health and well-being.
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10 There was evidence that the design of rotas was not the only factor working against well-
11 being. Trainees were often working beyond their rostered hours for voluntary reasons of
12 workload, perceived need to gain educational opportunities, and collegiality, but also for
13 more external reasons such as the expectations of others and gaps in the rota. Notably
14 these are corollaries of the voluntary reasons – rota gaps increase workload, and adverse
15 cultures may define professional practice. Contrary to recent recommendations that ‘every
16 moment count’ towards education in the workplace,⁴² for some trainees at least there is
17 increasing separation between work and education, and an increase in work intensity that
18 may be adding new stresses to the trainee population.
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30 The current study provides evidence that three years after the implementation of the WTR,
31 and with rotas that are at least compliant on paper, fatigue remains an issue for doctors in
32 training. This reflects some findings in the literature that a reduction in working hours alone is
33 not enough. The issue of increased work intensity and greater stress was noted amongst US
34 residents when working hours were further restricted.⁴³ Performing the same amount of work
35 in fewer hours (work compression) is of concern regarding workload⁴⁴ and overall well-
36 being,⁴⁵ and may place trainee doctors at risk of burnout.⁴⁶ Although much of the literature
37 relating to fatigue comes from the USA where restricted working hours are still much longer
38 than in Europe (e.g. >24 hour shifts until 2011, or 80-hour weeks), two UK self-report studies
39 conducted shortly after implementation of the 48-hour working week have highlighted the
40 effect of different schedules on fatigue, including the negative effect of working seven
41 consecutive nights, having only one day of rest after night shifts, intervals of less than ten
42 hours between shifts, and shifts of twelve consecutive days.^{30 31} Difficulty achieving naps
43 during night shifts, and poor provision for naps, has been reported elsewhere.³³ The current
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3 study has identified that fatigue is related to a number of complex issues, including rota
4 design, but also including contextual issues such as staff shortages and rota gaps, and
5 broader professional and cultural issues.
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10 Cultural issues within healthcare have been found to include fatigue not being taken
11 seriously, lack of discussion of fatigue issues and lack of support for napping.⁴⁷ The culture
12 of medicine needs to value sleep and appropriate work schedules.⁴⁸ Long working hours
13 may be a symptom of, and contribute to, an adverse culture. Expectations of long hours,
14 coupled with a lack of their explicit recognition, may be symptomatic of 'institutionalised
15 disrespect' of workers,³⁴ which if it is felt to be normal may lead to further dysfunctional
16 behaviours. Culture, particularly at the level of basic underlying assumptions that may
17 underpin day-to-day work, can be extremely difficult to change.^{34 49} In a study of paramedics,
18 podiatrists and occupational therapists, the working environment was found to be an
19 important factor in encouraging and developing professionalism.^{44 50} Some trainees in the
20 current study felt undermined by aspects of the professional and organisational culture and
21 felt there was a lack of recognition of the extra hours they worked. This was compounded by
22 pressure from seniors to work and record compliant hours during monitoring periods, even if
23 that was unrepresentative of the usual functioning of the rota. This highlights tensions that
24 can be experienced by trainee doctors who are required to work in compliance with the WTR
25 but also meet the demands of the healthcare service and the needs of patients, and
26 simultaneously want to satisfy their own professional standards and maximise their
27 educational opportunities.
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48 In other professions and industries the organisation of work, and the professional and
49 organisational cultures they engender or reinforce (such as a culture of long working hours;
50 cultural attitudes towards napping), has also been linked to fatigue, performance, safety,
51 health and well-being. Such professions and industries include nursing,⁵¹ aviation,⁵² the
52 police,⁵³ truck driving,⁵⁴ the shipping industry⁵⁵ and the construction industry.⁵⁶ It has also
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3 been found, in a study of metropolitan train drivers, that the successful adoption of fatigue
4 management strategies can be positively or negatively affected by aspects of the
5 organisational culture, such as altruism and camaraderie.⁵⁷ A culture of denial of vulnerability
6 to stress and the effects of fatigue on performance has been identified in both aviation and
7 medicine,⁵⁸ although one study found this to a lesser extent in aviation.⁵⁹
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14 Work hours are closely related to psychosocial work characteristics such as work demands
15 and autonomy.⁶⁰ Optimal amount and quality of workload, and opportunities for control at
16 work are among the psychosocial criteria identified for a good work environment and good
17 work organisation, and typically show dependence on national and organisational culture
18 and values,⁶¹ however individual differences in the desire or need for control need to be
19 taken into account.⁶² High work demands and work intensity, and lack of autonomy (and
20 particularly a combination of these) have been associated with health problems.⁶³ In a study
21 of US nurses, high job demands were associated with greater fatigue when job control was
22 low.⁶⁴ Ability to influence working hours (worktime control) has been associated with fewer
23 subjective health complaints,⁶⁵ and with decreased work strain and decreased perceived
24 stress.⁶⁶
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38 The broader cultural issues identified in relation to trainees' professional autonomy and the
39 relationship between trainees and their seniors are of current relevance in light of the Francis
40 report's recommendations for fundamental culture change in the NHS.⁶⁷ Following these
41 recommendations, it has been argued that more sophisticated understandings of cultural
42 dynamics and the role of policy in shaping these may be needed.⁶⁸ Fatigue may be an
43 important mediating variable in the perpetuation of adverse cultures and practice failings,
44 and as such should be an important component of any policies to monitor and improve
45 workplace cultures.
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55 Evaluation of the WTR must be considered in relation to the historical context within which
56 they were implemented. Perceptions of the WTR were not isolated from other changes
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3 affecting working hours, particularly the 1991 New Deal for Junior Doctors, which imposed
4 restrictions for the first time. At an organisational level, changes relating to the reorganisation
5 of specialty training over the last 20 years⁶⁹ affected the working environment. Trainees now
6 have to settle on a career specialty training path sooner, meaning that the Senior House
7 Officer (SHO) posts they would have filled in other specialties for up to several years may
8 remain unfilled. These gaps are compounded by the reduction in the number of overseas-
9 qualified doctors entering the UK following changes to immigration policy in 2008. The
10 workload and hence fatigue experienced by individual trainees can therefore be seen as the
11 end-point of many contributory factors.
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21 **Strengths and limitations**

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24 The strength of the current study is the breadth of trainee participants, covering a range of
25 training grades and specialties and all four nations of the UK, so gaining a picture across the
26 trainee experience. A weakness is that the trainee participants were volunteers to the study,
27 and as such may be open to self-selection bias. However, this risk is mitigated by the
28 instance of one group, run as part of Foundation Programme teaching, where all but four of
29 a cohort of F1s were able to attend. That group identified the same issues as the wider
30 sample, suggesting the prevalence of the concerns identified is not limited to a particularly
31 engaged sample. There may also be some instances of inaccuracy in individual recall
32 regarding the exact hours trainees worked.
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44 **Conclusion**

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46 The WTR have reduced the hours junior doctors work, but have not fully addressed
47 problems of fatigue and stress, due to issues in their implementation and other contextual
48 factors. The long term risks of this continued stress and fatigue, for the doctors themselves
49 and for the effective delivery of a healthcare service, should not be ignored.
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3 Future research could usefully involve an investigation of work intensity and its effects on
4 doctors' education, performance and well-being, and its impact on patient care. Such
5 research should consider the clinical demands of different specialties and the working
6 environment. Policy and practice could consider how best to monitor both working hours and
7 doctors' well-being. The closer and more effective involvement of trainees in rota design,
8 with consideration of the physiological aspects of sleep and fatigue, may help to avoid some
9 stresses, but there may need to be more fundamental consideration of necessary staffing
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References

1. Morrow G, Burford B, Carter M, *et al.* *The Impact of the Working Time Regulations on medical education and training: Literature review.* Report to the GMC, August 2012.
http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training___Literature_Review.pdf_51155615.pdf
2. Ayas NT, Barger LK, Cade BE, *et al.* Extended work duration and the risk of self-reported percutaneous injuries in interns. *JAMA* 2006;296:1055-62.
3. Fisman DN, Harris AD, Rubin M, *et al.* Fatigue increases the risk of injury from sharp devices in medical trainees: results from a case-crossover study. *Infect Cont Hosp Ep* 2007;28:10-17.
4. Barger LK, Ayas NT, Cade BE, *et al.* Impact of extended-duration shifts on medical errors, adverse events, and attentional failures. *PLOS Med* 2006;3:e487.
5. Gander P, Purnell H, Garden A, *et al.* Work patterns and fatigue-related risk among junior doctors. *Occup Environ Med* 2007;64:733-738.
6. Kohen-Raz R, Himmelfarb M, Tzur S, *et al.* An initial evaluation of work fatigue and circadian changes as assessed by multiplate posturography. *Percept Motor Skill* 1996;82:547-557.
7. Parshuram CS, Dhanani S, Kirsh JA, *et al.* Fellowship training, workload, fatigue and physical stress: A prospective observational study. *Can Med Assoc J* 2004;170:965-970.
8. Smith AM, Morris P, Rowell KO, *et al.* Junior doctors and the full shift rota - psychological and hormonal changes: a comparative cross-sectional study. *Clin Med* 2006;6:174-177.
9. Block L, Wu AW, Feldman L, *et al.* Residency schedule, burnout and patient care among first-year residents. *Postgrad Med J* 2013;89:495-500.

10. Gohar A, Adams A, Gertner E, *et al.* Working memory capacity is decreased in sleep-deprived internal medicine residents. *J Clin Sleep Med* 2009;5:191-197.
11. Lockley SW, Cronin JW, Evans EE, *et al.* Effect of reducing interns' weekly work hours on sleep and attentional failures. *New Engl J Med* 2004;351:1829-1837.
12. Jakubowicz DM, Price EM, Glassman HJ, *et al.* Effects of a twenty-four hour call period on resident performance during simulated endoscopic sinus surgery in an Accreditation Council for Graduate Medical Education-compliant training program. *Laryngoscope* 2005;115:143-146.
13. Gander P, Millar M, Webster C, *et al.* Sleep loss and performance of anaesthesia trainees and specialists. *Chronobiol Int* 2008; 25;1077-1091.
14. Brandenberger J, Kahol K, Feinstein AJ, *et al.* Effects of duty hours and time of day on surgery resident proficiency. *Am J Surg* 2010;200:814-818.
15. Ellman PI, Law MG, Tache-Leon C, *et al.* Sleep deprivation does not affect operative results in cardiac surgery. *Ann Thorac Surg* 2004;78:906-911.
16. Lehmann KS, Martus P, Little-Elk S, *et al.* Impact of sleep deprivation on medium-term psychomotor and cognitive performance of surgeons: prospective cross-over study with a virtual surgery simulator and psychometric tests. *Surgery* 2010;147:246-254.
17. Grantcharov TP, Bardram L, Funch-Jensen P, *et al.* Laparoscopic performance after one night on call in a surgical department: prospective study. *Brit Med J* 2001;323:1222-3.
18. Landrigan CP, Rothschild JM, Cronin JW, *et al.* Effects of reducing interns' work hours on serious medical errors in intensive care units. *New Engl J Med* 2004;351:1838-1848.
19. Lockley SW, Landrigan CP, Barger LK, *et al.* Harvard Work Hours, Health Safety Group. When policy meets physiology: the challenge of reducing resident work hours. *Clin Orthop Relat R* 2006;449:16-127.
20. Majekodunmi A, Landrigan CP. The effect of physician sleep deprivation on patient safety in perinatal-neonatal medicine. *Am J Perinat* 2012;29:43-48.
21. Vorona RD, Chen IA, Ware JC. Physicians and sleep deprivation. *Sleep Medicine Clinics* 2009;4:527-540.

- 1
2
3 22. Paice E, Hamilton-Fairley D. Avoiding burnout in new doctors: sleep, supervision and
4 teams. *Postgrad Med J* 2013;89:493.
5
6
7 23. Sokol DK. Waking up to the effects of fatigue in doctors. *Brit Med J* 2013;347:f4906.
8
9 24. Conigliaro J, Frishman WH, Lazar EJ, *et al*. Internal medicine housestaff and attending
10 physician perceptions of the impact of the New York State Section 405 regulations on
11 working conditions and supervision of residents in two training programs. *J Gen Intern*
12 *Med* 1993; 8:502-507.
13
14
15 25. Kort KC, Pavone LA, Jensen E, *et al*. Resident perceptions of the impact of work-hour
16 restrictions on health care delivery and surgical education: time for transformational
17 change. *Surgery* 2004;136:861-871.
18
19
20 26. Kiernan M, Civetta J, Bartus C, *et al*. 24 hours on-call and acute fatigue no longer
21 worsen resident mood under the 80-hour work week regulations. *Curr Surg* 2006;63:237-
22 241.
23
24
25 27. Cull WL, Mulvey HJ, Jewett EA, *et al*. Pediatric residency duty hours before and after
26 limitations. *Pediatrics* 2006;118:e1805-1811.
27
28
29 28. Reddy R, Guntupalli K, Alapat P, *et al*. Sleepiness in medical ICU residents. *Chest*
30 2009;135:81-85.
31
32
33 29. Berios I, Surani S, Simmons M. Assessing reaction time among emergency medicine
34 residents working different shift hours. *Ann Emerg Med* 2009; 54: S35.
35
36
37 30. Brown M, Tucker P, Rapport F, *et al*. The impact of shift patterns on junior doctors'
38 perceptions of fatigue, training, work/life balance and the role of social support. *Qual Saf*
39 *Health Care* 2010;19:e36.
40
41
42 31. Tucker P, Brown M, Dahlgren A, *et al*. The impact of junior doctors' worktime
43 arrangements on their fatigue and well-being. *Scand J Work Env Hea* 2010;36:458-46.
44
45
46 32. Arora V, Dunphy C, Chang VY, *et al*. The effects of on-duty napping on intern sleep time
47 and fatigue. *Ann Intern Med* 2006;144:792-798.
48
49
50
51
52
53
54
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56
57
58
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2
3 33. Jackson EJ, Moreton A. Safety during night shifts: a cross-sectional survey of junior
4 doctors' preparation and practice. *BMJ Open* 2013 3: doi: 10.1136/bmjopen-2013-
5 003567.
6
7
8
9 34. Leape LL, Shore MF, Dienstag JL, *et al.* A culture of disrespect, Part 1: The nature and
10 causes of disrespectful behavior by physicians. *Acad Med* 2012;87:845-852.
11
12 35. O'Gallagher MK, Lewis G, Mercieca K, *et al.* The impact of the European Working Time
13 Regulations on Ophthalmic Specialist Training - A national trainee survey. *Int J Surg*
14 2013: <http://dx.doi.org/10.1016/j.ijisu.2013.08.007>
15
16
17 36. Illing JC, Carter M, Thompson NJ, *et al.* *Evidence synthesis on the occurrence, causes,*
18 *consequences, prevention and management of bullying and harassing behaviours to*
19 *inform decision making in the NHS. Final report.* NIHR Service Delivery and Organisation
20 programme; 2013.
21
22
23 37. Williams ES, Konrad TR, Scheckler WE, *et al.* Understanding physicians' intentions to
24 withdraw from practice: the role of job satisfaction, job stress, mental and physical
25 health. *AHCM* 2001;2:243-262.
26
27
28 38. Edwards N, Kornacki MJ, Silversin J. Unhappy doctors: what are the causes and what
29 can be done? *Brit Med J* 2002;324:835-8.
30
31
32 39. Visser MRM, Smets EMA, Oort FJ, *et al.* Stress, satisfaction and burnout among Dutch
33 medical specialists. *CMAJ* 2003;168:271-5.
34
35
36 40. Morrow G, Burford B, Carter M, *et al.* *The Impact of the Working Time Regulations on*
37 *medical education and training: Final report on primary research.* Report to the GMC,
38 August 2012. [http://www.gmc-](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf_51157039.pdf)
39 [uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Tr](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf_51157039.pdf)
40 [aining_Final_Report_on_Primary_Research.pdf_51157039.pdf](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf_51157039.pdf)
41
42
43
44
45
46
47
48
49
50
51
52 41. Ritchie J, Spencer L. Qualitative data analysis for applied policy research. In: Bryman A,
53 Burgess RG, editors. *Analysing Qualitative Data.* London: Routledge; 1994. p.173-194.
54
55
56
57
58
59
60

- 1
2
3 42. Temple J. Time for Training: A review of the impact of the European Working Time
4 Directive on the quality of training. 2010.
5
6 http://www.mee.nhs.uk/pdf/JCEWTD_Final%20report.pdf
7
8
- 9 43. Auger KA, Sieplinga KR, Simmons JM, *et al*. Failure to thrive: Pediatric residents weigh
10 in on feasibility trial of the proposed 2008 Institute of Medicine work hour restrictions. *J*
11 *Grad Med Educ* 2009;1:181-184.
12
- 13 44. Goitein L. Resident workload – Let’s treat the disease, not just the symptom. *JAMA*
14 *Intern Med* 2013;173:655-656.
15
- 16 45. Auger KA, Landrigan CP, Gonzalez del Ray JA, *et al*. Better rested but more stressed?
17 Evidence of the effects of resident work hour restrictions. *Acad Pediatr* 2012;12:335-343.
18
- 19 46. Wayne DB, Arora V. Resident duty hours and the delicate balance between education
20 and patient care. *J Gen Intern Med* 2008;23:1120-1121.
21
- 22 47. Ferguson SA, Neall A, Dorrian J. Strategies used by healthcare practitioners to manage
23 fatigue-related risk: beyond work hours. *Medical Sociology online* 2013;7:24-33.
24
- 25 <http://www.medsoconline.org/>
26
27
- 28 48. Buysse DJ, Barzansky B, Dinges D, *et al*. Sleep, fatigue, and medical training: setting an
29 agenda for optimal learning and patient care. A report from the Conference “Sleep,
30 fatigue and medical training: Optimizing learning and the patient care environment”.
31 *Sleep* 2003;2:218-225.
32
- 33 49. Schein EH. Organisational culture and leadership. 4th edn. Jossey-Bass, 2010.
34
- 35 50. Morrow G, Burford B, Rothwell C, *et al*. *Professionalism in healthcare professionals.*
36 *Perceptions of professionalism*. Final report to the hpc, 2011. [http://www.hpc-](http://www.hpc-uk.org/assets/documents/10003771Professionalisminhealthcareprofessionals.pdf)
37 [uk.org/assets/documents/10003771Professionalisminhealthcareprofessionals.pdf](http://www.hpc-uk.org/assets/documents/10003771Professionalisminhealthcareprofessionals.pdf)
38
39
- 40 51. Rogers AE. The effects of fatigue and sleepiness on nurse performance and patient
41 safety. In: Hughes RG. editor. Patient safety and quality: An evidence-based handbook
42 for nurses. Rockville (MD): Agency for Healthcare Research and Quality (US); 2008.p2-
43 509-2-533.
44
45
46
47
48
49
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52
53
54
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56
57
58
59
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- 1
2
3 52. Gregory KB, Winn W, Johnson K, *et al.* Pilot fatigue survey: Exploring fatigue factors in
4
5 air medical operations. *Air Med J* 2010;29:309-319.
6
7 53. Vila B. Impact of long work hours on police officers and the communities they serve. *Am*
8
9 *J Ind Med* 2006;49:972-980.
10
11 54. Sabbagh-Ehrlich S, Friedman L, Richter E. Working conditions and fatigue in
12
13 professional truck drivers at Israeli ports. *Inj Prev* 2005;11:110-114.
14
15 55. Xhellilaj E, Lapa K. The role of human fatigue factor towards maritime casualties.
16
17 *Maritime Transport & Navigation Journal* 2010;2:23-32.
18
19 56. Dong X. Long workhours, work scheduling and work-related injuries among construction
20
21 workers in the United States. *Scand J Work Environ Health* 2005;31:329-335.
22
23 57. Rainbird S, Thompson K, Dawson D. The impact of organisational culture on fatigue
24
25 management: The case of camaraderie amongst metropolitan train drivers. In: Sargent
26
27 C, Darwent D, Roach GD. editors. *Living in a 24/7 world: The impact of circadian*
28
29 *disruption on sleep, work and health.* Adelaide: Australasian Chronobiology Society;
30
31 2010.p.29-33.
32
33 58. Helmreich RL. On error management: lessons from aviation. *Brit Med J* 2000;320:781-
34
35 785.
36
37 59. Sexton JB, Thomas EJ, Helmreich RL. Error, stress and teamwork in medicine and
38
39 aviation: cross sectional surveys. *Brit Med J* 2000;320:745-749.
40
41 60. Härmä M. Workhours in relation to work stress, recovery and health. *Scand J Work*
42
43 *Environ Health* 2006;32:502-514.
44
45 61. Lindström K. Psychosocial criteria for good work organization. *Scand J Work Environ*
46
47 *Health* 1994;20:123-133.
48
49 62. Sparks K, Faragher B, Cooper CL. Well-being and occupational health in the 21st
50
51 century workplace. *J Occup Organ Psych* 2001;74:489-509.
52
53 63. Eurofound. Fifth European working conditions survey. Publications Office of the
54
55 European Union, Luxembourg, 2012.
56
57 <http://www.eurofound.europa.eu/pubdocs/2011/82/en/1/EF1182EN.pdf>
58
59
60

- 1
2
3 64. Van Yperen NW, Hagedoorn M. Do high job demands increase intrinsic motivation or
4 fatigue or both? The role of job control and job social support. *Acad Manage J*
5 2003;46:339-348.
6
7
8
9 65. Costa G, Akerstedt T, Nachreiner F, *et al.* Flexible working hours, health, and well-being
10 in Europe: some considerations from a SALTSA project. *Chronobiol Int* 2004;21:831-
11 844.
12
13
14
15 66. Kandolin I, Huida O. Individual flexibility: an essential pre-requisite in arranging shift
16 schedules for midwives. *J Nurs Manag* 1996;4:213-217.
17
18
19 67. Francis R. *Report of the Mid Staffordshire NHS Foundation Trust public inquiry.*
20 Stationery Office, 2013.
21
22
23 68. Davies H, Mannion R. Will prescriptions for cultural change improve the NHS? *Brit Med J*
24 2013;346:f1305.
25
26
27 69. HMSO. Hospital Doctors: Training for the future. The report of the working group on
28 specialist medical training. HMSO, 1993.
29
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4 **Have restricted working hours reduced junior doctors' experience of fatigue? A focus**
5 **group and telephone interview study**
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ABSTRACT

Objective To explore the effects of the UK Working Time Regulations (WTR) on trainee doctors' experience of fatigue.

Design Qualitative study involving focus groups and telephone interviews, conducted in **Spring 2012** with doctors purposively selected from Foundation and specialty training. **Final compliance with a 48 hour per week limit had been required for trainee doctors since August 2009.** Framework analysis of data.

Setting Nine deaneries in all four UK nations; secondary care.

Participants 82 doctors: 53 Foundation trainees and 29 specialty trainees. Thirty-six participants were male, 46 female. Specialty trainees were from a wide range of medical and surgical specialties, and psychiatry.

Results Implementation of the WTR, whilst acknowledged **as** an improvement to the earlier situation of prolonged excessive hours, has not wholly overcome experience of long working hours and fatigue. Fatigue did not **only** arise from **the hours that were scheduled**, but also from an unpredictable mixture of shifts, work intensity (which often resulted in educational tasks being taken home), and inadequate rest. **Fatigue** was also caused by trainees working beyond their **scheduled hours**, for reasons **such as task completion**, accessing **additional** educational opportunities **beyond** scheduled hours, and staffing **shortages**. There were also organisational, professional and cultural **drivers**, such as a sense of responsibility to patients and colleagues and the expectations of seniors. Fatigue was perceived to affect efficiency of skills and judgement, mood, and learning capacity.

Conclusions Long-term risks of continued stress and fatigue, for doctors and for the effective delivery of a healthcare service, should not be ignored. **Current monitoring processes do not reflect doctors' true working patterns. The effectiveness of the WTR cannot be considered in isolation from the culture and context of the workplace.** On-going attention

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3 needs to be paid to broader cultural issues, including the relationship between trainees and
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For peer review only

ARTICLE SUMMARY

Article focus

The aim of the paper is to explore the effects of the UK Working Time Regulations (WTR) on trainee doctors' experience of fatigue.

Key messages

- The implementation of the WTR, whilst acknowledged to be an improvement to the earlier situation of prolonged excessive hours, has not wholly overcome experience of long working hours and fatigue. Reasons for persistent fatigue include the organisation of working patterns, work compression and intensity - thus also taking more work home – and working longer than rostered hours. This was related to taking up extra educational opportunities at work and to professional and organisational culture, including trainees' sense of responsibility towards patients and colleagues and the expectations of seniors. Current monitoring processes **do not reflect doctors' true working patterns**. ~~lack sensitivity to issues regarding rotas and hours worked.~~
- Effects on fatigue and on education cannot be isolated from other contextual factors, including workforce issues.
- On-going attention needs to be paid to broader cultural issues identified in relation to expectations placed on trainees and the relationship between trainees and their seniors.

Strengths and limitations

- The strength of the study is the breadth of trainee participants, covering a range of training grades and specialties and all four nations of the UK.
- A potential weakness is that participants were volunteers to the study, and as such may be open to self-selection bias. However, this risk is mitigated by the instance of one group run as part of Foundation Programme teaching, where all but four of a cohort of Foundation Year One trainees (F1s) were able to attend. That group

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3 identified the same issues as the wider sample, suggesting the prevalence of the
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5 issues identified is not limited to a particularly engaged sample. There may also be
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7 potential inaccuracies in individual recall of hours worked.
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3 **Title: Have restricted working hours reduced junior doctors' experience of fatigue? A**
4 **focus group and telephone interview study**
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8 **Introduction**
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12 There is a considerable body of evidence recognising that fatigue has adverse physiological,
13 psychological and cognitive effects and can lead to deficits in performance and safety.¹

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15 Fatigue in doctors is associated with increases of risks to personal safety at work^{2 3} and
16 outside work,^{4 5} and risks to health and well-being.⁶⁻⁹ There is also evidence of detriments to
17 performance, for example in cognitive abilities^{10 11} and psychomotor skills¹²⁻¹⁴ (although
18 some studies have found no performance effects^{15 16}). Fatigue has also been associated
19 directly with negative consequences for patient safety such as clinical errors and diagnostic
20 mistakes.^{4 5 17-20} This has been a concern in medicine for several years²¹ and remains so
21 today.^{22 23} The effects may be compounded by a risk that doctors do not recognise that they
22 may be subject to adverse effects.²³
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34 Several countries have introduced limits on working hours. For example, in the USA, since
35 2003, there has been national implementation of an Accreditation Council for Graduate
36 Medical Education (ACGME) 80-hour resident work week restriction, averaged over four
37 weeks; however the limit is lower in Europe. The European Working Time Directive (EWTD)
38 was introduced to limit hours, to address health and safety concerns for all workers arising
39 from long hours. Each European Union member state implemented the Directive in its own
40 legislation – the UK as the Working Time Regulations (1998). These Regulations (the WTR)
41 have applied fully to junior doctors since 2009, with a limit of 48 hours per week, averaged
42 across a reference period of 26 weeks, alongside specified minimum rest periods. The WTR
43 are implemented in rotas (work schedules) alongside the New Deal, which specifies a
44 maximum of 56 hours per week, with a system of banded payments.
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3 Positive effects of a reduction in working hours have been found in many studies,²⁴⁻²⁶ but not
4 all.^{27 28} The effect varies with the precise implementation of restrictions, with fatigue affected
5 by work patterns including the number of consecutive days or nights worked, the intervals
6 between shifts, and the timing of shifts (day/evening/night).²⁹⁻³¹ Short naps may ameliorate
7 the negative effects of fatigue,³² and awareness of the benefits of naps and other
8 recommendations and interventions to limit fatigue associated with rotating shift work may
9 be needed.³³

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18 Organisational cultures of long or antisocial hours³⁴ may also be a factor impacting on stress
19 and fatigue, and trainees have reported being unofficially expected to work extra hours
20 voluntarily.³⁵ Furthermore workload pressures and poor work design may increase risks of
21 negative behaviours among staff.³⁶ Limits on professional autonomy – the amount of control
22 doctors have traditionally held over their practice – may also increase doctors' stress and
23 reduce job satisfaction.³⁷⁻³⁹

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32 Consequently, simply restricting the number of work hours may be insufficient to address
33 issues relating to fatigue and its consequences. With this in mind, the question is raised
34 whether the WTR will have achieved the aim of improving junior doctors' well-being and
35 fatigue. To date, there has been little research looking directly at the effects of the WTR as
36 implemented and experienced in practice. This paper draws on a larger research study
37 considering perceptions of the effects of the WTR,⁴⁰ and focuses specifically on their effects
38 on trainee doctors' fatigue.

39 40 41 42 43 44 45 46 47 48 **Method**

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51 The research was reviewed by the Durham University School of Medicine, Pharmacy and
52 Health Ethics Sub-Committee, and a favourable ethical opinion received.

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56 Focus groups and telephone interviews (with participants who were unable to attend a focus
57 group) were conducted with Foundation Year One (FY1) and Foundation Year Two (FY2)

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3 trainees and specialty trainees, sampled purposively from nine deaneries in all four nations
4 of the UK. The Foundation Programme is a two-year generic training programme undertaken
5 after completing medical school, and is followed by specialist or general practice training.
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9 The WTR apply to all years of training in the same way.
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11
12 The focus group topic guide and interview questions focused on perceptions and experience
13 of working hours following the WTR and any educational or personal impact. Trainees were
14 asked about their knowledge of the WTR; their perceptions of their working hours in practice,
15 including shifts, rotas and compliance; issues concerning educational opportunities;
16 monitoring of working hours, and any personal effects they experienced. Some specialty
17 trainees had experience of working before the introduction of the WTR, and were asked
18 about the change.
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27 Recruitment was undertaken following local advice; in some cases through the Deanery, in
28 others through education centres in individual hospitals. An information sheet about the
29 study was distributed to trainees via email from the Deaneries or individual Trusts, and
30 participation was on a voluntary basis. Written consent was taken at the start of focus groups
31 and verbal consent at the start of telephone interviews, including consent for audio
32 recording. Recordings were later transcribed. GM and BB conducted the focus groups and
33 telephone interviews. Focus groups lasted between 60 and 90 minutes, and telephone
34 interviews between 30 and 45 minutes.
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45 **Analysis**

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47 Data were analysed using a framework approach.⁴¹ An initial stage of familiarisation, to gain
48 an overall view of the data, involved reading the transcripts and noting the range and depth
49 in the data collected. Meetings between all four researchers engaged in this process (GM,
50 BB, MC, JI) enabled discussion of the concepts and themes that emerged from the data. A
51 thematic framework was subsequently identified by GM and BB. This involved identifying the
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key issues, concepts or themes by which the data could be examined and sorted. The construction of the framework drew upon:

- *a priori* issues - those issues that were known or assumed to be pertinent, that guided the study aims and were developed into the topic guide/interview schedule;
- *emergent* issues - those issues that were raised by the respondents (e.g. issues relating to work intensity);
- *analytic* issues - those themes that emerged from patterns and re-occurrences in the data (e.g. professionalism)

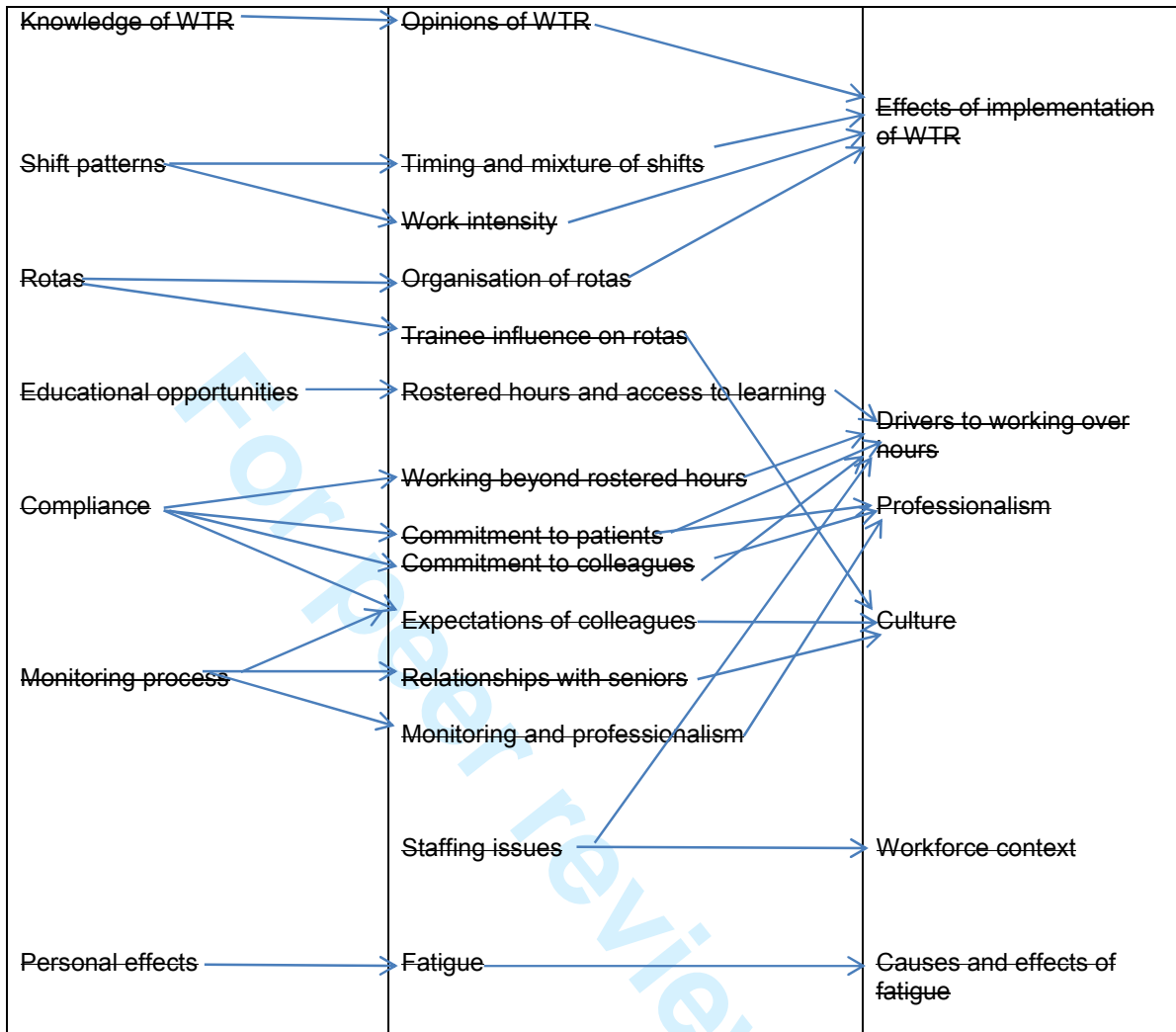
The framework was then applied to the data by GM and BB through indexing and charting, and themes and sub-themes were further refined. Finally, a stage of mapping and interpretation involved bringing the key themes within the data set together and pulling together the findings of the analysis as a whole. Table 1 summarises the main *a priori* themes, emergent themes, and analytic themes related to fatigue and illustrates the mapping and interpretation of the themes. The process of analysis helped provide an explanation of why fatigue remains an issue, and of the inter-relatedness of the issues identified.

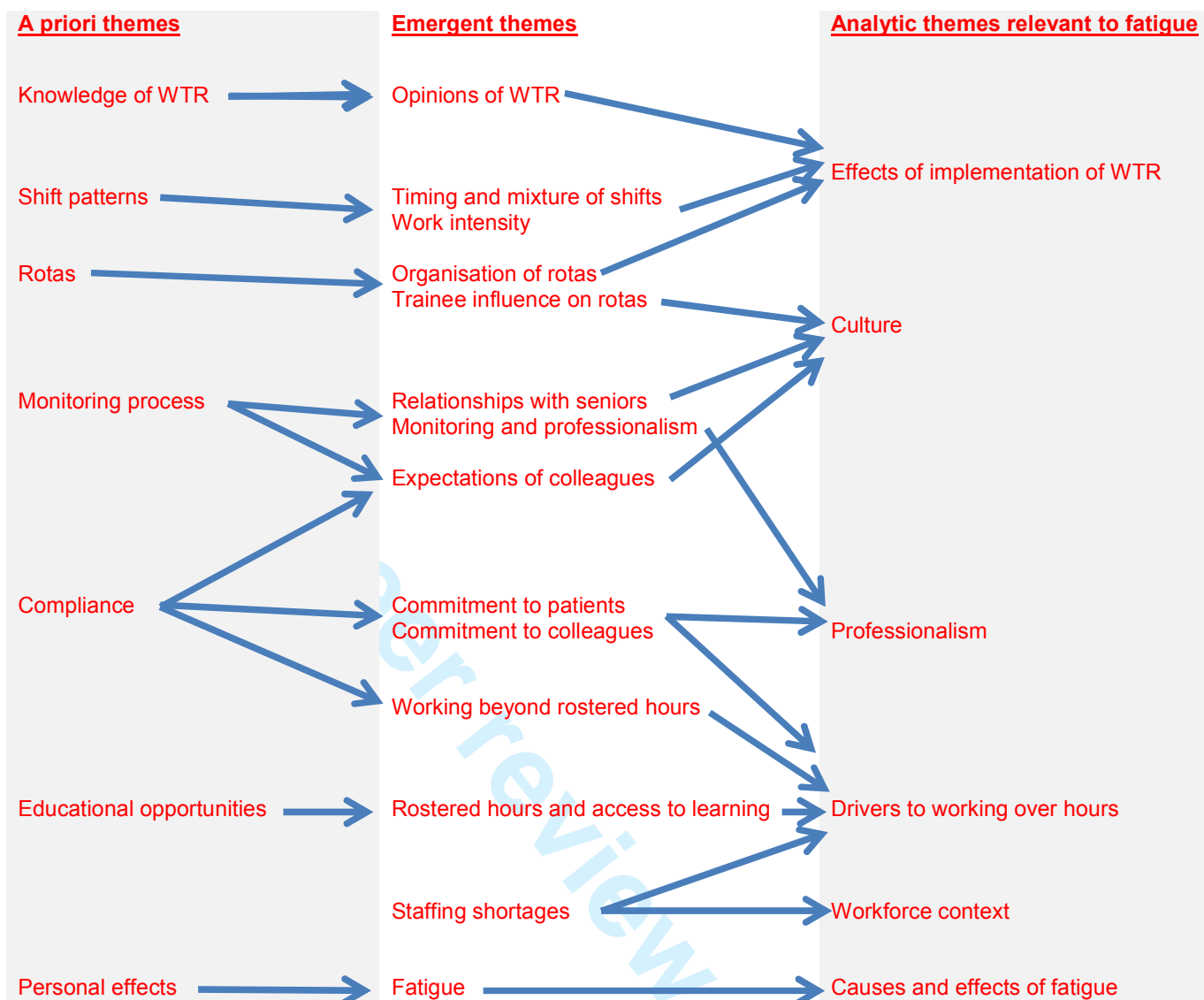
Data from focus groups and telephone interviews were analysed concurrently and no differences in themes were identified.

Table 1. Development of themes in framework analysis

A priori themes	Emergent themes	Analytic themes relevant to fatigue
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Findings

Eleven focus groups and 30 telephone interviews were conducted with 82 junior doctors.

See Table 2 for details of the training grades of participants.

Table 2. Training grades of participants

Foundation Year 1 (FY1)	Foundation Year 2 (FY2)	Core or specialty training up to CT/ST3*	ST4 or higher **
40	13	7	22
Total Foundation trainees: 53		Total specialty trainees: 29	

* These are trainees in the first three years of their specialty training, and were likely to have started specialty training after the WTR introduction in 2009.

** These are in higher specialty training, in their fourth year or above.

Thirty-six participants were male and 46 were female. Specialty trainee participants were training in a wide range of medical and surgical specialties, and psychiatry.

An overview summary of the findings from the data is presented in Table 3 below.

Table 3. Summary Overview of findings

Overall findings	Detail of findings
Perceived effects of WTR on working hours	General agreement that working hours were much improved under WTR; 48-hour limit appropriate (but desire for greater flexibility); intended benefits achieved to some extent
Implementation of WTR in practice: effects on fatigue	Different shift systems and patterns of work (timing and adjustment). Long periods without a day off. Averaging over 26 weeks can still allow over 48 working hours in one week. Work compression/work intensity. Rest periods not always taken.
Drivers to work long hours	Workload/completion of tasks. Taking up educational opportunities at work. Taking work home. Commitment and responsibility to patients and colleagues; collegiality. Cultural expectations. Professional reputation. Views of nature of professionalism. Workforce issues.
Effects of fatigue	Detriment to skills and judgement: most felt to affect efficiency rather than safety. Negative effect on ability to retain new information. Mood and manner (compounded by physical discomfort and hunger)

Perceived effects of WTR on working hours

There was general agreement that working hours were much improved under the WTR, and that intended benefits in terms of reduced trainee fatigue and improved work-life balance had been achieved to some extent. Many trainees felt that the 48-hour limit was appropriate and enabled sufficient training experience, albeit with a perceived lack of flexibility.

“I think, speaking to people who didn’t have the forty-eight hour working time directive thing, we get a lot more time to go home and enjoy ourselves and be outside the hospital than they ever did and I think that’s a good thing, I feel like I’ve got a bit more of a life.” (Tel. Int. 22, Foundation)

Implementation of WTR in practice: effects on fatigue

However, some participants did report still working long hours and experiencing fatigue despite the 48-hour limit and this was found to be related to a number of factors including the way in which the Regulations were implemented and other organisational and contextual factors.

The WTR have not entirely eliminated long hours, with some trainees giving examples of working up to 100 hours in a week. However, fatigue did not necessarily arise just from the long hours worked, but also the organisation of work within those hours, for example the mixture of day and night shifts, and long shifts straddling day and night (e.g. 2.00pm to 2.00am). Rotas could involve five consecutive days at work with 13-hour shifts, and working up to 12 consecutive days or, for some, seven consecutive nights (despite Royal College recommendations to the contrary). Trainees reported that averaging meant that a working week could exceed 70 hours and remain compliant.

“I don’t think the hours are long, so doing a 12 hour day or 13 hour day is fine, I think doing 12 days in a row you hit delirium about day ten and then you over-ride it...so I

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3 *don't think it's the shift I think it's the number of days you work in a row.*" (Focus
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5 group 3, Foundation)

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8 *"There's no continuity in terms of predictability of, right this is what I'm doing and, for*
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10 *example, my rota you run an eight cycle rota so you've got eight weeks to get*
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12 *through and none of those eight weeks are the same at all, and you jump around with*
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14 *longs and lates in-between and I think that from my side is what creates fatigue."*

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16 (Focus group 10, Specialty)

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20 *"That was a particularly difficult shift on the assessment suite because you would go*
21
22 *from five long days with maybe two days off, or a day off sometimes, and then onto a*
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24 *period of nights, you are constantly swapping from nights to days which was tiring,*
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26 *and 12 hour shifts and 13 hour shifts were always a bit of a drag."* (Tel. Int. 22,

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28 Foundation)

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31 There was also a perception that twelve-hour shifts were more fatiguing, with less 'down-
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33 time' than longer but less intense on-call sessions. Work intensity was also increased by
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35 rotas involving cross-cover out of hours.
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39 *"My personal opinion is [the WTR have] actually increased fatigue and stress in the*
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41 *fact that you feel you have to get an increased amount of work done in a shorter*
42
43 *amount of time."* (Tel. Int. 16, Foundation)

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46 Provision of facilities for taking rest during a night shift was also being reduced which,
47
48 alongside less capacity to take breaks or compensatory rest, added to the fatigue
49
50 experienced. Rest periods were also lost in half days – sometimes inserted into rotas to
51
52 balance hours – not always being taken, sometimes because senior clinical staff were
53
54 unaware of them, so workload did not respond to working hours.
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3 *“The trouble with night shift is being able to sleep during the day and most hospitals*
4 *have no facility to actually catch a nap while on nights. The last time I worked in a*
5 *hospital with bedrooms for on-call staff was in 2007 and that’s despite guidance from*
6 *the Royal College of Physicians that it should be possible for someone to have a*
7 *short nap.”* (Tel. Int. 23, Specialty)

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14 *“The difficulty is you may be entitled to various half days but the chances of them*
15 *actually materialising are very slight...unless these things are really formalised and*
16 *recognised they just don’t happen. I mean you can just about get your half day off*
17 *before nights because everyone understands that you’re about to start nights...but*
18 *the rest of them just don’t happen.”* (Tel. Int. 19, Foundation)

24 **Drivers to work long hours**

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30 Fatigue did not just arise from hours specified in rota design. There were many reasons,
31 including some voluntary, for trainees working beyond their rostered (scheduled) hours.

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35 Some reasons for working longer hours than scheduled stemmed from the capacity to fit
36 workload into the working period. This was more evident in shift work, where there was a
37 feeling that incoming doctors in the evening may not have the capacity to perform non-
38 urgent tasks, so the present doctor would finish those tasks before leaving. In contrast, in
39 on-call rotas a trainee would simply pass the bleep to the incoming doctor and so have a
40 cleaner handover.
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49 *“You kind of know yourself if I was to leave this work it’s only going to be there for me*
50 *in the morning and there’s a ward round in the morning, so I will have to get loads*
51 *more work handed my way. So you want to get things finished.”* (Tel. Int. 2,
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55 Foundation)

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3 Other drivers came from missing educational opportunities if trainees did not attend work
4 outside the rota, including going to work on rostered days off. These opportunities included
5 attending ward rounds and observing in theatre. While benefits of the WTR for work-life
6 balance were perceived, there was a sense that some educational activity that had been part
7 of the 'work' domain was now being taken home. This included portfolio completion and
8 reading that may have been done in the workplace during slack periods on-call.
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17 *"If you haven't got enough time to eat or go to the toilet, you can't leave work on time,*
18 *then you definitely don't have time to go to clinics, you definitely don't have time to do*
19 *audits or anything like that during work, it basically means that anything that is*
20 *exclusively for your own training is basically done in your own time and the amount of*
21 *time available to you is really diminished."* (Tel. Int. 7, Specialty)
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28 Although this increased their working hours and reduced time for rest and recuperation, the
29 benefit of taking up such opportunities was often seen to outweigh this.
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34 *"I've got no problems with the fact that I work a little bit over and take the extra time*
35 *to get training opportunities and that increases my hours to get better at my job.*
36 *That's personal sacrifice, personal advancement type stuff to get a better job to*
37 *become a consultant."* (Focus group 11, Specialty)
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43 There were also professional and cultural reasons for working beyond rostered hours. These
44 related to the expectations and norms perceived among their professional group and the
45 workplace. Trainee doctors often worked beyond rostered hours due to a sense of
46 commitment and responsibility, both to patients and to colleagues. There were cases of
47 trainees staying late to hand over the care of a patient, rather than force two handovers (for
48 example where a junior doctor would stay to complete an admission in A&E, rather than
49 hand over to another FY2 doctor, who would then have to hand over to the specialty where
50 the patient was being admitted), due to concern for continuity of care and the risk of
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3 information being lost. There was also a strong sense of collegiality, expressed as a
4 responsibility not to burden colleagues with routine tasks particularly as they were likely to
5 face other immediate demands at the handover time.
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10 *“We have just never taken the half days because we’re so busy, you know; we could*
11 *have done, but would have screwed over our colleagues.”* (Focus group 2,
12 Foundation)
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17 At times, however, this could be perceived as a cultural expectation that some jobs would
18 not be left – so less a choice, more an imposition. There were references to a negative
19 culture where trainees could experience pressure from senior doctors, and other
20 professions, to stay beyond their rostered hours, with implication of unprofessionalism if they
21 left on time. There was also a perception amongst trainees that their professional reputation
22 was at risk, with implications for an employment reference and future career.
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31 Concerns about working hours were often not recognised or appreciated by seniors, with
32 some respondents identifying a dismissive attitude towards the WTR, and a feeling that such
33 limitations were counter to medical professionalism. Some trainees also agreed that limited
34 hours undermined professional autonomy, a feeling exacerbated if hours were enforced
35 during the periodic two-week monitoring process.
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43 *“If you clicked that you started at 8.00 and you were meant to start at 9.00, you had*
44 *to explain...why did you do it, so quite a lot of the time I wouldn’t put down that I*
45 *started before 9.00 because I knew I was going to have to justify that I came in*
46 *before 9.00.”* (Focus group 5, Foundation)
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53 Trainees reported that, as WTR compliance is derived from these New Deal monitoring
54 reports, there was no objective record of hours worked, and there were also no formal
55 measures for health and well-being. However, few trainees kept their own record of hours
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3 worked despite their being conscious of working beyond rostered hours. This was partly due
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5 to their view of medicine and the nature of their work, meaning that working to limited hours
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7 was not an issue to them.
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11 *“We are treated usually like we are working late due to our own failings which is not a*
12 *nice atmosphere to work in, I think it’s very important that you feel you are working,*
13 *especially as a junior in a new career, you’re working somewhere you are*
14 *appreciated, valued and not being looked at suspiciously.”* (Tel. Int. 21, Foundation)
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20 Gaps in rotas also placed additional pressure on the system, and so on individual doctors.
21
22 These arose from staff shortages caused by under-recruitment, as well as absences. This
23
24 often meant providing informal cover, for example in extended shifts. While locums were
25
26 used, external locums were felt to be sometimes unreliable, meaning last minute cover was
27
28 often necessary. Formal internal locum shifts were sometimes used, and cross-referenced
29
30 against rotas to ensure an individual did not exceed WTR hours, and there was no reported
31
32 pressure to undertake locum shifts. The trainees reported that there was a shortage of
33
34 available doctors to fill rotas, even without the need to comply with the WTR. Some trainees
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36 felt that even fully staffed rotas would be stretched because the workload had increased
37
38 since the staffing levels were initially put in place.
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42 *“The fundamental issue is trying to do a decent job and you can’t do a decent job if*
43 *there aren’t enough of you on the ground, so you are always working many hours in*
44 *excess of what you should be doing, you end up tired and exhausted and jaded and*
45 *then you’re not doing a good job for your patient.”* (Tel. Int. 29, Foundation)
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51 **Effects of fatigue**

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54 Trainees identified effects of fatigue arising from their working hours. While detriments to
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56 their skills and judgement were identified, these were mostly felt to affect efficiency rather
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3 than safety – however risks to patient safety cannot be discounted. Some reported that
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5 fatigue affected their ability to retain new information.
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8 *“I think when you were getting to the end of a thirteen hour shift you found that your*
9 *technical skills, like your ability to put a cannula into someone and stuff like that, it*
10 *certainly decreases, I find it gets a lot harder to do things that require more*
11 *concentration, things like that, but I think you’re also quite aware of that, so patient*
12 *safety wise you are aware that you are not at your best so you often check more of*
13 *your decisions with other people and things like that.”* (Tel. Int. 22, Foundation)
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17 *“I think 12 days in a stretch is too long without a day off, I just think it’s a really long*
18 *stretch...I think [the effect] is fatigue really and I suppose you learn less towards the*
19 *end of those days really because you are just tired.”* (Tel. Int. 26, Foundation)
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28 Fatigue was also reported to affect mood, particularly when switching between different
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30 working patterns, with consequences for their professional manner. This may have
31
32 consequences for team-working and interprofessional communication, as well as for
33
34 interactions with patients.
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37 *“You become more irritable sometimes as well, I noticed I was a bit more snappy*
38 *[when switching between long days and nights]* (Focus group 5, Foundation)
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42 *“You don’t make as good decisions and you’re more grumpy, you’re less likely to be*
43 *good with the patients, you know, you’re more likely to just go in there and take the*
44 *blood rather than actually you know being a doctor to them...so you have to be a lot*
45 *more careful when you’re tired I suppose.”* (Tel. Int. 9, Foundation)
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52 These issues were sometimes compounded by hunger and discomfort arising from not
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54 achieving rest breaks during long shifts.
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3 *"I think when I'm hungry my fuse is shorter and I think my compassion towards others*
4 *is not as what it should be."* (Tel. Int. 2, Foundation)
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8 A summary of the Findings is presented in Table 3 below.
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12 **Table 3. Summary of findings**

Overall findings	Detail of findings
Perceived effects of WTR on working hours	General agreement that working hours were much improved under WTR; 48 hour limit appropriate (but desire for greater flexibility); intended benefits achieved to some extent
Implementation of WTR in practice: effects on fatigue	Different shift systems and patterns of work (timing and adjustment). Long periods without a day off. Averaging over 26 weeks can still allow over 48 working hours in one week. Work compression/work intensity. Rest periods not always taken.
Drivers to work long hours	Workload/completion of tasks. Taking up educational opportunities at work. Taking work home. Commitment and responsibility to patients and colleagues; collegiality. Cultural expectations. Professional reputation. Views of nature of professionalism. Workforce issues.
Effects of fatigue	Detriment to skills and judgement: most felt to affect efficiency rather than safety. Negative effect on ability to retain new information. Mood and manner (compounded by physical discomfort and hunger)

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39 **Discussion**

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41 Despite the introduction of restricted working hours for junior doctors in the UK, long hours
42 and fatigue remain, with associated consequences for performance. There was general
43 agreement that restricting working hours was a positive thing, but that problems remained
44 with acute workload in some working patterns. Conversely, while most felt that a 48 hour
45 limit was appropriate, some would like more flexibility to exceed it when necessary.
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53 It was considered that the amount of work to be carried out had not reduced, increasing the
54 perceived intensity of work. Some working patterns were considered particularly intense and
55 detrimental to personal well-being – with consequences for performance and education.
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3 Long periods without a day off in particular were tiring. There is no objective record of hours
4 worked, as WTR compliance is derived from New Deal monitoring reports, and trainees
5 reported no formal measures for health and well-being.
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10 There was evidence that the design of rotas was not the only factor working against well-
11 being. Trainees were often working beyond their rostered hours for voluntary reasons of
12 workload, perceived need to gain educational opportunities, and collegiality, but also for
13 more external reasons such as the expectations of others and gaps in the rota. Notably
14 these are corollaries of the voluntary reasons – rota gaps increase workload, and adverse
15 cultures may define professional practice. Contrary to recent recommendations that ‘every
16 moment count’ towards education in the workplace,⁴² for some trainees at least there is
17 increasing separation between work and education, and an increase in work intensity that
18 may be adding new stresses to the trainee population.
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30 The current study provides evidence that three years after the implementation of the WTR,
31 and with rotas that are at least compliant on paper, fatigue remains an issue for doctors in
32 training. This reflects some findings in the literature that a reduction in working hours alone is
33 not enough. The issue of increased work intensity and greater stress was noted amongst US
34 residents when working hours were further restricted.⁴³ Performing the same amount of work
35 in fewer hours (work compression) is of concern regarding workload⁴⁴ and overall well-
36 being,⁴⁵ and may place trainee doctors at risk of burnout.⁴⁶ Although much of the literature
37 relating to fatigue comes from the USA where restricted working hours are still much longer
38 than in Europe (e.g. >24 hour shifts until 2011, or 80-hour weeks), two UK self-report studies
39 conducted shortly after implementation of the 48-hour working week have highlighted the
40 effect of different schedules on fatigue, including the negative effect of working seven
41 consecutive nights, having only one day of rest after night shifts, intervals of less than ten
42 hours between shifts, and shifts of twelve consecutive days.^{30 31} Difficulty achieving naps
43 during night shifts, and poor provision for naps, has been reported elsewhere.³³ The current
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3 study has identified that fatigue is related to a number of complex issues, including rota
4 design, but also including contextual issues such as staff shortages and rota gaps, and
5 broader professional and cultural issues.
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10 Cultural issues within healthcare have been found to include fatigue not being taken
11 seriously, lack of discussion of fatigue issues and lack of support for napping.⁴⁷ The culture
12 of medicine needs to value sleep and appropriate work schedules.⁴⁸ Long working hours
13 may be a symptom of, and contribute to, an adverse culture. Expectations of long hours,
14 coupled with a lack of their explicit recognition, may be symptomatic of 'institutionalised
15 disrespect' of workers,³⁴ which if it is felt to be normal may lead to further dysfunctional
16 behaviours. Culture, particularly at the level of basic underlying assumptions that may
17 underpin day-to-day work, can be extremely difficult to change.^{34 49} In a study of paramedics,
18 podiatrists and occupational therapists, the working environment was found to be an
19 important factor in encouraging and developing professionalism.⁴⁴⁻⁵⁰ Some trainees in the
20 current study felt undermined by aspects of the professional and organisational culture and
21 felt there was a lack of recognition of the extra hours they worked. **This was compounded by
22 pressure from seniors to work and record compliant hours during monitoring periods, even if
23 that was unrepresentative of the usual functioning of the rota. This highlights tensions that
24 can be experienced by trainee doctors who are required to work in compliance with the WTR
25 but also meet the demands of the healthcare service and the needs of patients, and
26 simultaneously want to satisfy their own professional standards and maximise their
27 educational opportunities.**
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48 In other professions and industries the organisation of work, and the professional and
49 organisational cultures they engender or reinforce (such as a culture of long working hours;
50 cultural attitudes towards napping), has also been linked to fatigue, performance, safety,
51 health and well-being. Such professions and industries include nursing,⁵¹ aviation,⁵² the
52 police,⁵³ truck driving,⁵⁴ the shipping industry⁵⁵ and the construction industry.⁵⁶ It has also
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3 been found, in a study of metropolitan train drivers, that the successful adoption of fatigue
4 management strategies can be positively or negatively affected by aspects of the
5 organisational culture, such as altruism and camaraderie.⁵⁷ A culture of denial of vulnerability
6 to stress and the effects of fatigue on performance has been identified in both aviation and
7 medicine,⁵⁸ although one study found this to a lesser extent in aviation.⁵⁹
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14 Work hours are closely related to psychosocial work characteristics such as work demands
15 and autonomy.⁶⁰ Optimal amount and quality of workload, and opportunities for control at
16 work are among the psychosocial criteria identified for a good work environment and good
17 work organisation, and typically show dependence on national and organisational culture
18 and values,⁶¹ however individual differences in the desire or need for control need to be
19 taken into account.⁶² High work demands and work intensity, and lack of autonomy (and
20 particularly a combination of these) have been associated with health problems.⁶³ In a study
21 of US nurses, high job demands were associated with greater fatigue when job control was
22 low.⁶⁴ Ability to influence working hours (worktime control) has been associated with fewer
23 subjective health complaints,⁶⁵ and with decreased work strain and decreased perceived
24 stress.⁶⁶
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38 The broader cultural issues identified in relation to trainees' professional autonomy and the
39 relationship between trainees and their seniors are of current relevance in light of the Francis
40 report's recommendations for fundamental culture change in the NHS.⁶⁷ Following these
41 recommendations, it has been argued that more sophisticated understandings of cultural
42 dynamics and the role of policy in shaping these may be needed.⁶⁸ Fatigue may be an
43 important mediating variable in the perpetuation of adverse cultures and practice failings,
44 and as such should be an important component of any policies to monitor and improve
45 workplace cultures.
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55 Evaluation of the WTR must be considered in relation to the historical context within which
56 they were implemented. Perceptions of the WTR were not isolated from other changes
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3 affecting working hours, particularly the 1991 New Deal for Junior Doctors, which imposed
4 restrictions for the first time. At an organisational level, changes relating to the reorganisation
5 of specialty training over the last 20 years⁶⁹ affected the working environment. Trainees now
6 have to settle on a career specialty training path sooner, meaning that the Senior House
7 Officer (SHO) posts they would have filled in other specialties for up to several years may
8 remain unfilled. These gaps are compounded by the reduction in the number of overseas-
9 qualified doctors entering the UK following changes to immigration policy in 2008. The
10 workload and hence fatigue experienced by individual trainees can therefore be seen as the
11 end-point of many contributory factors.
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21 **Strengths and limitations**

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24 The strength of the current study is the breadth of trainee participants, covering a range of
25 training grades and specialties and all four nations of the UK, so gaining a picture across the
26 trainee experience. A weakness is that the trainee participants were volunteers to the study,
27 and as such may be open to self-selection bias. However, this risk is mitigated by the
28 instance of one group, run as part of Foundation Programme teaching, where all but four of
29 a cohort of F1s were able to attend. That group identified the same issues as the wider
30 sample, suggesting the prevalence of the concerns identified is not limited to a particularly
31 engaged sample. There may also be some instances of inaccuracy in individual recall
32 regarding the exact hours trainees worked.
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44 **Conclusion**

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46 The WTR have reduced the hours junior doctors work, but have not fully addressed
47 problems of fatigue and stress, due to issues in their implementation and other contextual
48 factors. The long term risks of this continued stress and fatigue, for the doctors themselves
49 and for the effective delivery of a healthcare service, should not be ignored.
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3 Future research could usefully involve an investigation of work intensity and its effects on
4 doctors' education, performance and well-being, and its impact on patient care. Such
5 research should consider the clinical demands of different specialties and the working
6 environment. Policy and practice could consider how best to monitor both working hours and
7 doctors' well-being. The closer and more effective involvement of trainees in rota design,
8 with consideration of the physiological aspects of sleep and fatigue, may help to avoid some
9 stresses, but there may need to be more fundamental consideration of necessary staffing
10 levels.
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References

1. Morrow G, Burford B, Carter M, *et al.* *The Impact of the Working Time Regulations on medical education and training: Literature review.* Report to the GMC, August 2012.
http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Literature_Review.pdf 51155615.pdf
2. Ayas NT, Barger LK, Cade BE, *et al.* Extended work duration and the risk of self-reported percutaneous injuries in interns. *JAMA* 2006;296:1055-62.
3. Fisman DN, Harris AD, Rubin M, *et al.* Fatigue increases the risk of injury from sharp devices in medical trainees: results from a case-crossover study. *Infect Cont Hosp Ep* 2007;28:10-17.
4. Barger LK, Ayas NT, Cade BE, *et al.* Impact of extended-duration shifts on medical errors, adverse events, and attentional failures. *PLOS Med* 2006;3:e487.
5. Gander P, Purnell H, Garden A, *et al.* Work patterns and fatigue-related risk among junior doctors. *Occup Environ Med* 2007;64:733-738.
6. Kohen-Raz R, Himmelfarb M, Tzur S, *et al.* An initial evaluation of work fatigue and circadian changes as assessed by multiplate posturography. *Percept Motor Skill* 1996;82:547-557.
7. Parshuram CS, Dhanani S, Kirsh JA, *et al.* Fellowship training, workload, fatigue and physical stress: A prospective observational study. *Can Med Assoc J* 2004;170:965-970.
8. Smith AM, Morris P, Rowell KO, *et al.* Junior doctors and the full shift rota - psychological and hormonal changes: a comparative cross-sectional study. *Clin Med* 2006;6:174-177.
9. Block L, Wu AW, Feldman L, *et al.* Residency schedule, burnout and patient care among first-year residents. *Postgrad Med J* 2013;89:495-500.
10. Gohar A, Adams A, Gertner E, *et al.* Working memory capacity is decreased in sleep-deprived internal medicine residents. *J Clin Sleep Med* 2009;5:191-197.

- 1
2
3 11. Lockley SW, Cronin JW, Evans EE, *et al.* Effect of reducing interns' weekly work hours
4 on sleep and attentional failures. *New Engl J Med* 2004;351:1829-1837.
- 5
6
7 12. Jakubowicz DM, Price EM, Glassman HJ, *et al.* Effects of a twenty-four hour call period
8 on resident performance during simulated endoscopic sinus surgery in an Accreditation
9 Council for Graduate Medical Education-compliant training program. *Laryngoscope*
10 2005;115:143-146.
- 11
12
13 13. Gander P, Millar M, Webster C, *et al.* Sleep loss and performance of anaesthesia
14 trainees and specialists. *Chronobiol Int* 2008; 25;1077-1091.
- 15
16
17 14. Brandenberger J, Kahol K, Feinstein AJ, *et al.* Effects of duty hours and time of day on
18 surgery resident proficiency. *Am J Surg* 2010;200:814-818.
- 19
20
21 15. Ellman PI, Law MG, Tache-Leon C, *et al.* Sleep deprivation does not affect operative
22 results in cardiac surgery. *AnnThorac Surg* 2004;78:906-911.
- 23
24
25 16. Lehmann KS, Martus P, Little-Elk S, *et al.* Impact of sleep deprivation on medium-term
26 psychomotor and cognitive performance of surgeons: prospective cross-over study with
27 a virtual surgery simulator and psychometric tests. *Surgery* 2010;147:246-254.
- 28
29
30 17. Grantcharov TP, Bardram L, Funch-Jensen P, *et al.* Laparoscopic performance after one
31 night on call in a surgical department: prospective study. *Brit Med J* 2001;323:1222-3.
- 32
33
34 18. Landrigan CP, Rothschild JM, Cronin JW, *et al.* Effects of reducing interns' work hours
35 on serious medical errors in intensive care units. *New Engl J Med* 2004;351:1838-1848.
- 36
37
38 19. Lockley SW, Landrigan CP, Barger LK, *et al.* Harvard Work Hours, Health Safety Group.
39 When policy meets physiology: the challenge of reducing resident work hours. *Clin*
40 *Orthop Relat R* 2006;449:16-127.
- 41
42
43 20. Majekodunmi A, Landrigan CP. The effect of physician sleep deprivation on patient
44 safety in perinatal-neonatal medicine. *Am J Perinat* 2012;29:43-48.
- 45
46
47 21. Vorona RD, Chen IA, Ware JC. Physicians and sleep deprivation. *Sleep Medicine Clinics*
48 2009;4:527-540.
- 49
50
51 22. Paice E, Hamilton-Fairley D. Avoiding burnout in new doctors: sleep, supervision and
52 teams. *Postgrad Med J* 2013;89:493.
- 53
54
55
56
57
58
59
60

- 1
2
3 23. Sokol DK. Waking up to the effects of fatigue in doctors. *Brit Med J* 2013;347:f4906.
4
5 24. Conigliaro J, Frishman WH, Lazar EJ, *et al.* Internal medicine housestaff and attending
6
7 physician perceptions of the impact of the New York State Section 405 regulations on
8
9 working conditions and supervision of residents in two training programs. *J Gen Intern*
10
11 *Med* 1993; 8:502-507.
12
13 25. Kort KC, Pavone LA, Jensen E, *et al.* Resident perceptions of the impact of work-hour
14
15 restrictions on health care delivery and surgical education: time for transformational
16
17 change. *Surgery* 2004;136:861-871.
18
19 26. Kiernan M, Civetta J, Bartus C, *et al.* 24 hours on-call and acute fatigue no longer
20
21 worsen resident mood under the 80-hour work week regulations. *Curr Surg* 2006;63:237-
22
23 241.
24
25 27. Cull WL, Mulvey HJ, Jewett EA, *et al.* Pediatric residency duty hours before and after
26
27 limitations. *Pediatrics* 2006;118:e1805-1811.
28
29 28. Reddy R, Guntupalli K, Alapat P, *et al.* Sleepiness in medical ICU residents. *Chest*
30
31 2009;135:81-85.
32
33 29. Berios I, Surani S, Simmons M. Assessing reaction time among emergency medicine
34
35 residents working different shift hours. *Ann Emerg Med* 2009; 54: S35.
36
37 30. Brown M, Tucker P, Rapport F, *et al.* The impact of shift patterns on junior doctors'
38
39 perceptions of fatigue, training, work/life balance and the role of social support. *Qual Saf*
40
41 *Health Care* 2010;19:e36.
42
43 31. Tucker P, Brown M, Dahlgren A, *et al.* The impact of junior doctors' worktime
44
45 arrangements on their fatigue and well-being. *Scand J Work Env Hea* 2010;36:458-46.
46
47 32. Arora V, Dunphy C, Chang VY, *et al.* The effects of on-duty napping on intern sleep time
48
49 and fatigue. *Ann Intern Med* 2006;144:792-798.
50
51 33. Jackson EJ, Moreton A. Safety during night shifts: a cross-sectional survey of junior
52
53 doctors' preparation and practice. *BMJ Open* 2013 3: doi: 10.1136/bmjopen-2013-
54
55 003567.
56
57
58
59
60

- 1
2
3 34. Leape LL, Shore MF, Dienstag JL, *et al.* A culture of disrespect, Part 1: The nature and
4 causes of disrespectful behavior by physicians. *Acad Med* 2012;87:845-852.
5
6
7 35. O'Gallagher MK, Lewis G, Mercieca K, *et al.* The impact of the European Working Time
8 Regulations on Ophthalmic Specialist Training - A national trainee survey. *Int J Surg*
9 2013: <http://dx.doi.org/10.1016/j.ijisu.2013.08.007>
10
11
12
13 36. Illing JC, Carter M, Thompson NJ, *et al.* *Evidence synthesis on the occurrence, causes,*
14 *consequences, prevention and management of bullying and harassing behaviours to*
15 *inform decision making in the NHS. Final report.* NIHR Service Delivery and Organisation
16 programme; 2013.
17
18
19
20
21 37. Williams ES, Konrad TR, Scheckler WE, *et al.* Understanding physicians' intentions to
22 withdraw from practice: the role of job satisfaction, job stress, mental and physical
23 health. *AHCM* 2001;2:243-262.
24
25
26
27 38. Edwards N, Kornacki MJ, Silversin J. Unhappy doctors: what are the causes and what
28 can be done? *Brit Med J* 2002;324:835-8.
29
30
31 39. Visser MRM, Smets EMA, Oort FJ, *et al.* Stress, satisfaction and burnout among Dutch
32 medical specialists. *CMAJ* 2003;168:271-5.
33
34
35 40. Morrow G, Burford B, Carter M, *et al.* *The Impact of the Working Time Regulations on*
36 *medical education and training: Final report on primary research.* Report to the GMC,
37 August 2012. [http://www.gmc-](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf)
38 [uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Tr](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf)
39 [aining_Final_Report_on_Primary_Research.pdf](http://www.gmc-uk.org/The_Impact_of_the_Working_Time_Regulations_on_Medical_Education_and_Training_Final_Report_on_Primary_Research.pdf) 51157039.pdf
40
41
42
43
44
45 41. Ritchie J, Spencer L. Qualitative data analysis for applied policy research. In: Bryman A,
46 Burgess RG, editors. *Analysing Qualitative Data.* London: Routledge; 1994. p.173-194.
47
48
49 42. Temple J. Time for Training: A review of the impact of the European Working Time
50 Directive on the quality of training. 2010.
51
52
53
54 http://www.mee.nhs.uk/pdf/JCEWTD_Final%20report.pdf
55
56
57
58
59
60

- 1
2
3 43. Auger KA, Sieplinga KR, Simmons JM, *et al.* Failure to thrive: Pediatric residents weigh
4 in on feasibility trial of the proposed 2008 Institute of Medicine work hour restrictions. *J*
5 *Grad Med Educ* 2009;1:181-184.
6
7
8
9 44. Goitein L. Resident workload – Let’s treat the disease, not just the symptom. *JAMA*
10 *Intern Med* 2013;173:655-656.
11
12
13 45. Auger KA, Landrigan CP, Gonzalez del Ray JA, *et al.* Better rested but more stressed?
14 Evidence of the effects of resident work hour restrictions. *Acad Pediatr* 2012;12:335-343.
15
16
17 46. Wayne DB, Arora V. Resident duty hours and the delicate balance between education
18 and patient care. *J Gen Intern Med* 2008;23:1120-1121.
19
20
21 47. Ferguson SA, Neall A, Dorrian J. Strategies used by healthcare practitioners to manage
22 fatigue-related risk: beyond work hours. *Medical Sociology online* 2013;7:24-33.
23
24 <http://www.medsoconline.org/>
25
26
27 48. Buysse DJ, Barzansky B, Dinges D, *et al.* Sleep, fatigue, and medical training: setting an
28 agenda for optimal learning and patient care. A report from the Conference “Sleep,
29 fatigue and medical training: Optimizing learning and the patient care environment”.
30
31 *Sleep* 2003;2:218-225.
32
33
34
35 49. Schein EH. Organisational culture and leadership. 4th edn. Jossey-Bass, 2010.
36
37 50. Morrow G, Burford B, Rothwell C, *et al.* *Professionalism in healthcare professionals.*
38 *Perceptions of professionalism.* Final report to the hpc, 2011. [http://www.hpc-](http://www.hpc-uk.org/assets/documents/10003771Professionalisminhealthcareprofessionals.pdf)
39 [uk.org/assets/documents/10003771Professionalisminhealthcareprofessionals.pdf](http://www.hpc-uk.org/assets/documents/10003771Professionalisminhealthcareprofessionals.pdf)
40
41
42
43 51. Rogers AE. The effects of fatigue and sleepiness on nurse performance and patient
44 safety. In: Hughes RG. editor. Patient safety and quality: An evidence-based handbook
45 for nurses. Rockville (MD): Agency for Healthcare Research and Quality (US); 2008.p2-
46 509-2-533.
47
48
49
50
51 52. Gregory KB, Winn W, Johnson K, *et al.* Pilot fatigue survey: Exploring fatigue factors in
52 air medical operations. *Air Med J* 2010;29:309-319.
53
54
55
56 53. Vila B. Impact of long work hours on police officers and the communities they serve. *Am*
57 *J Ind Med* 2006;49:972-980.
58
59
60

- 1
2
3 54. Sabbagh-Ehrlich S, Friedman L, Richter E. Working conditions and fatigue in
4 professional truck drivers at Israeli ports. *Inj Prev* 2005;11:110-114.
5
6
7 55. Xhelilaj E, Lapa K. The role of human fatigue factor towards maritime casualties.
8
9 *Maritime Transport & Navigation Journal* 2010;2:23-32.
10
11 56. Dong X. Long workhours, work scheduling and work-related injuries among construction
12 workers in the United States. *Scand J Work Environ Health* 2005;31:329-335.
13
14
15 57. Rainbird S, Thompson K, Dawson D. The impact of organisational culture on fatigue
16 management: The case of camaraderie amongst metropolitan train drivers. In: Sargent
17 C, Darwent D, Roach GD. editors. Living in a 24/7 world: The impact of circadian
18 disruption on sleep, work and health. Adelaide: Australasian Chronobiology Society;
19 2010.p.29-33.
20
21
22 58. Helmreich RL. On error management: lessons from aviation. *Brit Med J* 2000;320:781-
23 785.
24
25
26 59. Sexton JB, Thomas EJ, Helmreich RL. Error, stress and teamwork in medicine and
27 aviation: cross sectional surveys. *Brit Med J* 2000;320:745-749.
28
29
30 60. Härmä M. Workhours in relation to work stress, recovery and health. *Scand J Work*
31 *Environ Health* 2006;32:502-514.
32
33
34 61. Lindström K. Psychosocial criteria for good work organization. *Scand J Work Environ*
35 *Health* 1994;20:123-133.
36
37
38 62. Sparks K, Faragher B, Cooper CL. Well-being and occupational health in the 21st
39 century workplace. *J Occup Organ Psych* 2001;74:489-509.
40
41
42 63. Eurofound. Fifth European working conditions survey. Publications Office of the
43 European Union, Luxembourg, 2012.
44
45
46 <http://www.eurofound.europa.eu/pubdocs/2011/82/en/1/EF1182EN.pdf>
47
48
49
50 64. Van Yperen NW, Hagedoorn M. Do high job demands increase intrinsic motivation or
51 fatigue or both? The role of job control and job social support. *Acad Manage J*
52 2003;46:339-348.
53
54
55
56
57
58
59
60

- 1
2
3 65. Costa G, Akerstedt T, Nachreiner F, *et al*. Flexible working hours, health, and well-being
4 in Europe: some considerations from a SALTSA project. *Chronobiol Int* 2004;21:831-
5 844.
6
7
8
9 66. Kandolin I, Huida O. Individual flexibility: an essential pre-requisite in arranging shift
10 schedules for midwives. *J Nurs Manag* 1996;4:213-217.
11
12
13 67. Francis R. *Report of the Mid Staffordshire NHS Foundation Trust public inquiry*.
14 Stationery Office, 2013.
15
16
17 68. Davies H, Mannion R. Will prescriptions for cultural change improve the NHS? *Brit Med J*
18 2013;346:f1305.
19
20
21 69. HMSO. Hospital Doctors: Training for the future. The report of the working group on
22 specialist medical training. HMSO, 1993.
23
24
25
26
27
28
29
30
31
32
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34
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41
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