RESEARCH ARTICLE

Residents' reported overtime and perceptions on safety climate, supervisor support and medical errors.

[version 1; peer review: 1 approved with reservations]

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Abstract

Background

The Dutch healthcare system relies heavily on residents. This group is thought to be especially susceptible because of the system of hierarchy and dependence in which they work. Multiple studies have related overtime, safety climate, and supervisory support to medical errors. The aim of this study was to examine these themes and their correlations.

Methods

This cross-sectional questionnaire included multiple validated scales, and demographic and employment data. Correlations between themes were calculated using linear regression analysis. Between-group analyses concerning residents' current position, department, clinical setting, and experience level compared the mean composite scores. The survey was distributed through Dutch physician associations and social media platforms between February and April 2020. 492 medical residents were included.

Results

Weekly average overtime was 7.8 hours, which was mostly

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uncompensated. Residents who were not in a training program, surgical residents, and those working in hospitals reported significantly more overtime. Over one in three felt they had fallen short in the quality of care they delivered. One-third of the respondents did not have a designated supervisor, and supervisor support scored mediocre overall. Medical errors were associated with a poorer safety climate, but other associations were not observed.

Conclusions

Overtime is abundant in residents, especially in surgical specialties. Safety is a priority but has a tendency to crumble under pressure. Strikingly, a substantial part of the residents felt that they had performed medical procedures that they were not properly trained for and that they had fallen short in the quality of care they delivered. Supervisor support was mostly present in the development of competencies and work-related problems, but residents reported poor rewarding behaviors, and a third did not have a designated mentor. Medical training programs should acknowledge the importance of these themes and make tangible efforts to monitor the needs and experiences of residents.

Keywords
Residents, Trainees, Safety culture, Supervision, Medical errors, Overtime, Survey

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Competing interests: The corresponding author was during the time of this research (2020) also a voluntary chair member of The Young Physician foundation (Dutch: Stichting De Jonge Dokter), which is also stated in the affiliations section. This foundation, led by junior doctors, is dedicated to supporting young doctors in the early stages of their career. We aim to drive cultural change in healthcare, mainly by addressing unspoken challenges in our network and the media.

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Introduction

The Dutch care system relies on many trained residents and *residents not yet in training*. Residents usually work for several years before being accepted into specialty training programmes. The lack of structure and intense competition to be accepted into a specialty training program make residency an unsteady career phase. There is a high workload and risk of insufficient job resources to compensate for this. Overtime and burnout[1] are apparent in this population, but little is known about the prevalence and effects of these work circumstances on job performance.

In the past decade, Dutch health care professionals have pressed the need for a healthier work culture, including less unpaid overtime, less work pressure, less hierarchy, and more psychological safety within teams. There is a new paradigm that might explain why professionals believe the system they work in is unhealthy yet does not collapse: Healthcare professionals might work in a so-called stretched system[2]. This implies that they work at their upper limits while still delivering acceptable results.

Recently, *overtime* has been recognized as a possible factor in increasing burnout and sick leave numbers, especially considering the recent COVID-19 pandemic. In early 2022, 9.1% of hospital nurses were on short-term (less than 90 days) sick leave, and this number has risen by approximately 50% since 2019[1]. This is in line with Patterson and Deutsch's discussion on stretched systems[2]. When trying to understand the relationship between overtime and burnout symptoms, a recent study by Kim *et al.* showed that compensation may be a key factor[3]. They reported that u*ncompensated* (neither money nor time) over time during the COVID-19 pandemic was associated with higher scores on the well-known Copenhagen Burnout Inventory[4]. Similar results were reported in a previous study[5] on the mediating effects of job control on the relationship between overtime and psychological distress, as measured by the validated K6 scale. This was based on the widely recognized Job Demands-Resources (JDR) model, which proposes that a balance between job demands and resources is key[6]. Simply stated, a more positive balance (i.e., resources > demands) could lead to less sick leave, less (intent-to-)turnover, and better performance. Moreover, Kevric *et al*. (2018) reported that increased working hours, unpaid overtime, and poor job security and satisfaction correlated with lower general health survey scores among Australian surgical trainees[7]. No studies have yet been performed to gain insight into overtime and its compensation, specifically among medical *residents not in training* in a Western European healthcare setting. Among residents in training, 17% of their work schedules did not adhere to national working hour laws[8], and one in three residents was unaware of its lawfulness[8]. Overtime appeared to be extensive: a mean weekly overtime of eight hours was reported, with 89% of residents being uncompensated[8]. Circling back to *job resources*, a recent Dutch study[9] revealed that in hospital settings, higher *supervisor support* was associated with higher voicing behaviors (i.e., *speaking up*). Bakker's JD-R Model[6] affirms supervisory support as a job resource. Additionally, 56% of residents in training reported that they felt that one or more supervisors left a negative mark on the safety climate of their team[8].

Multiple studies have been conducted on the relationship between safety culture and outcomes among healthcare professionals. A cross-sectional survey on safety climate in 150 hospital units in the USA[10] showed that poorer safety climate correlated with more nurse-reported medication errors and back injuries, moderated by patient complexity, while better safety climate correlated with higher nurse and patient satisfaction. Many studies have linked safety climate with adverse events. For instance, a higher safety culture was associated with a lower risk of postoperative adverse events or mortality[11], improved surgical outcomes[12], and reduced readmissions[13].

We aimed to offer a comprehensive overview of medical residents' perceptions of (1) overtime, (2) safety climate, (3) supervisor support, and (4) medical errors and their correlations to guide improvements in medical resident programs.

Methods

Study design

In this cross-sectional study, a questionnaire was used to inventory the attitudes of Dutch medical residents towards multiple work-related themes using validated questionnaires: 1) overtime, 2) safety climate[14], 3) supervisor support[15], and 4) medical errors[16], scored using a 5- or 7-point Likert scale. Concerning the definition of theme 1) over time, participants were first asked how many working hours per week were included in their contract, and then asked how many hours on average per week they worked on top of that. In this context, overtime was defined as 'any working hours on top of your contract hours.' The questions were answered by using a sliding bar. Translation to Dutch was performed via forward-backward translation methods, since a validated translation was not yet available. Questionnaire items and answer options on theme 1–4 are presented in Table 1 in English. The proposed interactions between these four themes are depicted in the framework in Figure 1, which is based on the JD-R model[6]. Additionally, this substantial questionnaire included questions on speaking up, work enthusiasm and pressure, burnout symptoms, psychological safety, and abuse of power, which will be reported separately for clarity. The study protocol was approved by the Medical Ethics Committee of the University Medical Center, Amsterdam (W20_152#20.191).

Framework and hypotheses

The proposed relationships between the different themes are shown in Figure 1. We hypothesize that theme 1) overtime has a positive correlation with theme 3) medical errors. Second, we hypothesize that theme 2) safety climate (low scores indicate good safety climate) is negatively correlated with theme 4) medical errors. Third, we hypothesized that theme 3) supervisor

Table 1. Questionnaire themes and items.

Theme	Items	Scale
1. Overtime	According to my contract, I work … hours per week. According to my contract, I work … What is the number of weekly overtime (hours you work on top of your contracted hours)? Are you compensated in time or money for overtime? (matrix question) - In time - In money	No. Parttime/fulltime No. Yes/No Yes/No/Sometimes Yes/No/Sometimes
2. Safety climate[14]	In my unit… i. in order to get the work done, one must ignore some safety aspects. ii. whenever pressure builds up, the preference is to do the job as fast as possible, even if that means compromising on safety. iii. human resource shortage undermines safety standards. iv. safety rules and procedures are ignored. v. safety rules and procedures are nothing more than a cover-up for lawsuits. vi. ignoring safety is acceptable. vii it doesn't matter how the work is done as long as there are no accidents.	5-point: not at all true in my unit – very true in my unit
3. Medical errors[16]	i. I make mistakes without negative consequences for the patient. ii. I perform procedures for which I am not properly trained. iii. I make mistakes that have negative consequences for the patient. iv. I discharge patients later because my workload is too heavy. v. I fall short in the quality of care I provide.	5-point: happened never – happened often
4. Supportive supervision[15]	Do you have a designated supervisor/mentor in your current job? Do you feel employers should provide all residents with a designated supervisor/mentor? My supervisor… i. helps me solve work-related problems. ii. encourages me to develop new skills. iii. keeps informed about how employees think and feel about things. iv. encourages employees to participate in important decisions. v. praises good work. vi. encourages employees to speak up when they disagree with a decision vii. refuses to explain his or her actions (reversed-coded). viii. rewards me for good performance.	Yes/No Yes/No/Don't know 7-point: strongly disagree – strongly agree

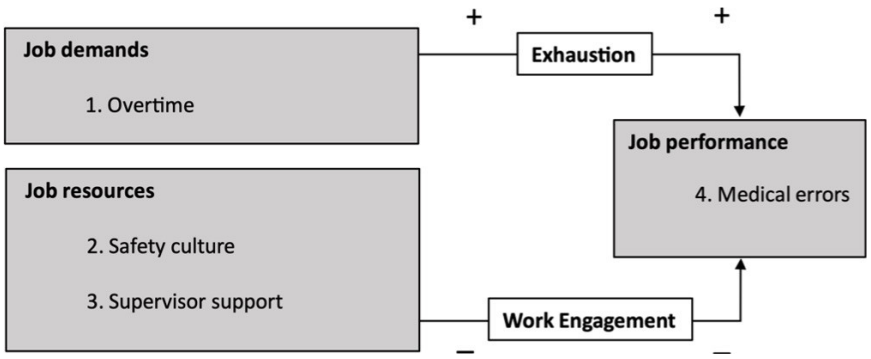

Figure 1. Framework stating the proposed relations between the themes in this questionnaire.

support is negatively correlated with theme 4) medical errors. In summary, more support and a higher perception of safety climate will be associated with fewer medical errors.

Participants

The questionnaire was administered to 'young physicians' in the Netherlands. No age limit was set for participation so that the questionnaire would appeal to medical students, interns, residents, resident-researchers (physician residents combining research with clinical duties), and registrars/attendings. Complete anonymity could be guaranteed to the participants due to the large number of respondents expected and not including questions on identifiable characteristics, such as name, age, gender, and employer. In this paper, we will only report the results for residents. Relevant demographic data included current position (in training, not in training, or resident-researcher), years of experience as a resident, clinical setting, and department (categorized as surgical, medical (non-surgical), or public health). Theme 1 was based on contracted work hours, overtime, and compensation.

Data collection

The call to participate in the questionnaire was distributed through the professional network of De Jonge Dokter (in English: The Young Physician Foundation), including online physician networks, multiple physician associations, and social media. Data collection took place at the start of the COVID-19 era between February and April 2020, through the website of Sardes, an affiliated independent research agency for this study. Survalyzer online software was used for this (https://survalyzer.com), but a free alternative would be Google Forms.

Data analyses

Continuous variables were checked for a normal distribution. Residents' experience was dichotomized from an initial 6-category question to a 2-category variable: either experienced' (graduated over 1 year ago) or 'relatively inexperienced (graduated less than 1 year ago). Residents' departments/specialties were categorized as surgical, medical (non-surgical), and public health.

- Theme 1: Reported overtime of up to 29 hours per week (~ 3 full working days) was accepted. For respondents reporting more than 29 hours of overtime per week or only overtime and no contracted hours (missing values), overtime entry was corrected to missing values because the validity of these answers was doubted. Missing values were never substituted at zero.
- Theme 2–4: mean composite score (MCS) and standard deviation (SD) were reported for all residents. Deviations from the norm (all residents) for all subgroups were calculated to provide insight into the differences between the groups of residents.

Correlations between themes 1 and 3, themes 2 and 3, and themes 4 and 3were analyzed using linear regression analyses.

For themes 2–4, between-group analyses were performed for current position (resident not in training vs. resident in training vs. resident researchers) and department (surgical vs. medical vs. public health residents) using a one-way ANOVA. Between-group analyses in a clinical setting (in-hospital residents vs. out-of-hospital residents or working in both) and experience (experienced vs. relatively inexperienced residents) were performed using independent sample t-tests comparing MCS.

Since this questionnaire omitted item 6 from the original scale[16] for theme 4) Medical errors, a Cronbach's α of 0.634 was calculated.

Results

Demographic

A total of 977 residents responded to the digital questionnaire call. Of these, 622 (63.6%) completed the questionnaire's general questions about the employment context (Table 1), and others (n=355) were excluded. Only residents in training, residents not in training, and resident researchers were included in our analyses since this paper focuses on clinical practice. Researchers (n=90), medical students (n=33), and respondents who did not report their department/specialty (n=4), clinical setting (n=2), or experience (n=2) were excluded.. The characteristics of the respondents (n=492) are listed in Table 2. The distribution of the respondents based on their current positions and departments is shown in Figure 2*.

Theme 1: Overtime

The residents' mean contracted hours were reported to be 38.4 hours per week (range 22–55, missing values= 8). Residents who were not in training had slightly longer baseline working weeks (M=38.0 hours, SD=4.4, p=0.0002) than resident researchers (M= 38.1, SD= 5.2) and residents in training (M=39.6, SD=5.9). In addition, the mean weekly overtime was 7.8 hours for all types of residents (range 0–28, missing values= 31). Comparing between departments (see Table 3), surgical residents (M=12.1, SD5.2) significantly increased over time (p< 0.001) compared to medical residents (M=7.4, SD=4.7) and public health residents (M=4.3, SD=4.7). In addition, a significant difference was found between residents not in training (M=8.3, SD=5.4), resident-researchers (M = 8.6, SD =6.1), and residents in training (M=6.2, SD=4.6). For in-hospital residents (M=8.5, SD=5.2), overtime was significantly higher (p<0.001) than that of residents working in out-of-hospital settings (M=4.1, SD=4.5) or both (M=7.8, SD=5.2), but

* Surgical residents were comprised of proceduralists and surgeons, including residents working in the following departments: general and trauma surgery, neurosurgery, plastic and reconstructive surgery, orthopedics, gastroenterology, ophthalmology, urology, gynecology and ear-nose-throat surgery. Medical residents included all non-proceduralists, including residents working in: internal medicine (including endocrinology, rheumatology, oncology, vascular and hematology), cardiology, pulmonology (including COVID-19 wards), pediatrics and neonatology, dermatology, bariatrics, anesthesiology, neurology, pathology, microbiology, fertility, obstetrics, geriatrics, intensive care, psychiatry, radiology (due to a relatively low number of interventional radiologists), radiotherapy and emergency medicine. Public health residents included family medicine, rehabilitation/occupational medicine, nursing home (elderly) care, sports medicine, insurance medicine, forensics, genetics, pharmacy, addition medicine, child/developmental medicine, mental health and environmental health.

Table 2. Demographic characteristics of residents (n= 492).

	n	%
Current position		
Resident not in training	345	70.1
Resident in training	121	24.6
Resident-researcher	26	5.3
Missing values	0	0
Clinical setting		
Hospital	404	82.1
Non-hospital or both	86	17.5
Missing values	2	0.4
Department		
Surgical	101	20.5
Medical (non-surgical)	302	61.4
Public Health	81	16.5
Missing values	8	1.6
Employment type		
Fulltime	377	76.6
Parttime	113	23.0
Missing values	2	0.4
Working experience		
<1 month	19	3.9
1–4 months	91	18.5
4–6 months	49	10.0
6–12 months	98	19.9
12–24 months	143	29.1
>24 months	90	18.3
Missing values	0	0

no significant difference was found between experienced (M=7.6, SD=5.6) and relatively inexperienced residents (M=8.1, SD=5.2) (p=-0.259). The differences among the medical specialties included in this study are shown in Figure 3.

Most residents reported that they received no compensation for their overtime, but compensation by free time was more common than in money. Compensation by free time was reported by 9.6% of residents, while 19.6% reported 'sometimes,' and 61.2% reported no compensation by time (missing values=39, 7.9%; and stated N/A: n=8, 1.6%). Compensation in money was less frequent, with 5.7% of residents reporting yes, 11.4% reporting 'sometimes,' and 71.7% reporting no compensation in money (missing values= 39, 7.9%; N/A: n = 10, 2.0%).

Internal medicine was chosen as the norm (Y-axis), since its mean overtime was closest to the overall mean of 7.8 hours per week.

Theme 2: Safety climate

The mean composite scores (MCS) for themes 2–4 are shown in Table 3. MCS was overall 2.3 (on a scale of 1–5, strongly disagree – strongly agree; missing values= 1) and only differed between subgroups considering the current position, where resident researchers perceived a slightly lower level of safety climate. The proportion of residents who agreed with the statement that safety rules and procedures were nothing more than a cover-up for lawsuits was 13.9% (n = 68, missing values= 4). 24.1% of residents (n =118, missing values=2) agreed that whenever pressure builds up in their unit, the preference is to do the job as fast as possible, even if that means compromising safety. In contrast, only 12.5% of the residents (n=61, missing values=4) agreed that ignoring safety was acceptable.

Theme 3: Medical errors

MCS on was 2.0 (on a scale of 1–5, strongly disagree – strongly agree; missing values=1) and did not differ significantly between the current position, department/specialty, clinical setting, and experience. The number of residents who performed a medical procedure that they were at the time not properly trained for more than 'a couple of times' was 128 out of 490 (26.2%). The number of residents who reported having made mistakes with negative consequences for the patient more than 'a couple of times' was 34 out of 489 (7.0%). Lastly, 179

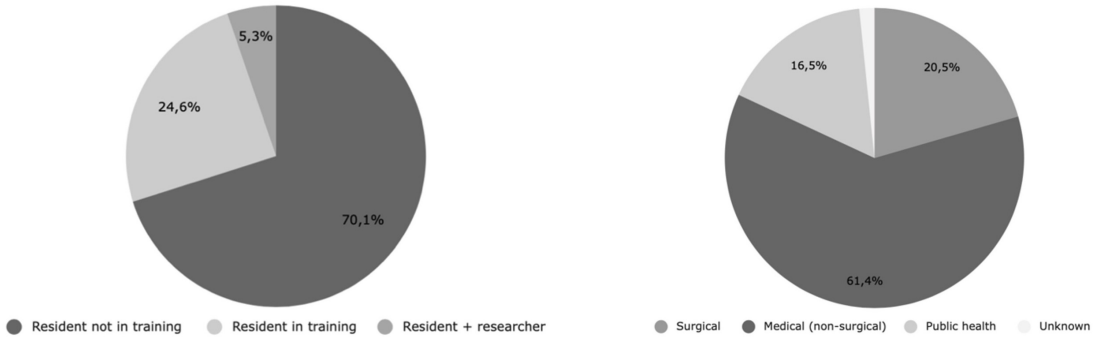

Figure 2. Distribution of respondents based on career phase and department.

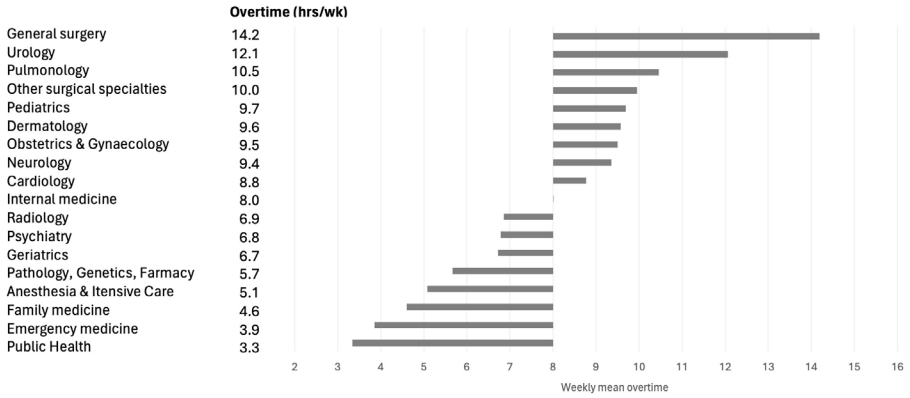

Figure 3. Overtime stratified to residents' specialty.

Table 3. Means per theme for all residents and deviations from this per demographic subgroup.

Demographic group	Theme 1 Overtime	Theme 2 Safety climate	Theme 3 Medical errors	Theme 4 Supervisor support
	Mean weekly overtime/ Deviation from norm	MCS† (SD) on scale 1–5/ Deviation from norm	MCS† (SD) score on scale 1–5/ Deviation from norm	MCS† (SD) on scale 1–7/ Deviation from norm
All residents: M† (SD)	**7.8 (5.4)**	**2.3 (0.7)**	**2.0 (0.5)**	**4.5 (0.9)**
Current position				
Resident not in training	+ 0.6	~	+ 0.1	~
Resident in training	– 1.6	– 0.1	+ 0.1	+ 0.2
Resident-researcher	+ 0.8	– 0.2	– 0.2	– 0.1
	p=0.001*	p= 0.046*	p= 0.128	p= 0.031*
Department/specialty				
Surgical	+ 4.3	– 0.1	+ 0.1	– 0.3
Medical (non-surgical)	– 0.4	~	~	~
Public health	– 3.5	– 0.1	~	+ 0.3
	p<0.001*	p= 0.260	p= 0.636	p<0.001*
Clinical setting				
In hospital	+ 0.7	~	~	~
Out of hospital (or both)	– 3.4	~	+ 0.1	+ 0.3
	p<0.001*	p= 0.830	p= 0.260	p<0.001*
Working experience				
< 1 year	+ 0.2	~	~	+ 0.1
> 1 year	– 0.3	~	+ 0.1	– 0.1
	p= 0.259	p= 0.830	p= 0.260	p=0.043*

Results: All residents = norm, as stated in bold in the first row. All the other rows present deviations from this norm.

†M= mean; MSC = mean composite score; SD = standard deviation

*statistically significant differences between subgroups

out of 489 (36.6%) residents feel they have fallen short in the quality of care they provide more than 'a couple of times.'

Theme 4: Supervisor support

Of all the residents, 67.1% (n=330) reported having a designated supervisor/mentor in their current job (n=161, 32.7% did not; missing values=1, 0.2%). Residents in training (73.6%) and resident researchers (88.5%) had a designated mentor significantly more often than residents who did not (63.4%, p=0.007). Residents mostly felt that their employers should provide a designated supervisor to all residents (yes: 85.3%, n=419; missing values =1, 0.2%; no: n=42, 8.5%; and do ot know n=30, 6.1%). Overall, MCS on supervisor support was overall 4.5 (on a scale of 1–7, strongly disagree – strongly agree; missing values=0), indicating mediocre support from supervisors. The MCS differed significantly between all subgroup analyses. Residents in training, inexperienced residents, residents in public health, and working outside hospitals scored significantly higher on supervisor support (see Table 3). Mean scores on items about 'help with work-related issues' and 'the development of new competencies' were 5.5 and 5.0 respectively (on a scale of 1–7, strongly disagree – strongly agree; missing values=2 resp. 0), whereas rewarding behaviors from supervisors scored poorly: 4.0 (missing values=2).

Correlations

- No correlation was found between Theme 1) Overtime and MCS for Theme 3) medical errors (R=0.011, p=0.814).
- No correlation was found between MCS for Theme 4) Supervisor support and Theme 3) Medical errors (R=0.060, p=0.182).
- A weak, positive correlation was found between MCS for Theme 3) Medical errors and Theme 2) Safety climate (R=0.302), which was statistically significant (p<0.001). This indicates that the lower the perceived safety climate, the more residents self-reported medical errors.

Discussion

Comparison to literature

Theme 1 Overtime: Overtime is substantial among Dutch residents. Surgical residents report making on average 4.7 hours more weekly overtime than medical residents (12.1 vs 7.4 hours of weekly overtime). Incentives for working this overtime likely include an inability to meet expectations from other physicians higher in the hierarchy within scheduled hours[17], or the 'overstretched' healthcare system demanding more care than is commonly accounted for.

No correlation between overtime and medical errors (Theme 3) was found in this study, which is probably due to many factors influencing medical errors among medical residents and their willingness to report.

Our data on overtime reinstates the results from 2018 among residents of training programs[8]. In comparison to other healthcare professionals, only one study reported on overtime among physicians, specifically radiation oncologists in New Zealand, who work 10 extra weekly hours on average[18], but no clear definition of overtime is provided here. In nurses, overtime has been extensively researched. Overtime has been shown to negatively affect nurses' collaboration with coworkers[19]. Moreover, mandatory overtime for at-home caregivers and nurses is linked to a higher risk of needlesticks, work-related injuries, work-related illnesses, and absenteeism[20,21]. A recent review of factors impacting medication errors concluded that hours of work impact the number of errors[22], but no distinction between scheduled hours and overtime was made (although this is imperative given the prevalence of part-time work). Additionally, it is not yet clear how *time of day* and *fatigue* play a role in this relationship.

Theme 2 Safety climate: The most remarkable results arose from several individual questionnaire items. For example, almost one in seven residents agreed that safety rules and procedures were nothing more than a cover-up for lawsuits. 1 in 4 residents believe that 'whenever pressure builds up, the preference is to do the job as fast as possible, even if that means compromising on safety.' This might indicate that the reasoning behind safety measures on the work floor is not always clear to healthcare professionals, or that the working pressure is simply too high.

The importance of the safety climate becomes clear when we consider the relevant literature. A study[23] using the same safety climate items as our questionnaire found a significant negative correlation between safety culture scores and observed clinical incidents in an interdisciplinary team ICU setting. This is in line with our hypothesis, and data indicating a lower safety climate are weakly correlated with medical errors (R=0.302, p<0.001). Considering all data on this theme, two things become clear: 1) safety is not always a top priority for residents in high-pressure environments, but this is not unique to the Dutch situation or to the healthcare profession; and 2) safety climate is associated with medical error reporting. The latter is probably mitigated through a myriad of factors, including understanding of safety importance, willingness to report, and speaking up behaviors, which this questionnaire cannot unveil.

Theme 3. Medical errors: Strikingly, one in four residents indicated that they performed a medical procedure that they were, at the time, not properly trained a couple of times, multiple times', or' often.' In addition, one in three feels that they have fallen short in the quality of care a couple of times or more in their careers. This touches on the topic of *moral distress*/injury among healthcare professionals (which is in turn associated with burnout[24]). The feeling of failure to provide care to patients might be a negative contributing factor to resident wellbeing.

Theme 4. Supervisor support: Roughly one in three residents does not have a designated supervisor/mentor in their current job, although the vast majority believe that their employer should provide one. Furthermore, having a designated supervisor could help minimize concerns about questions that reflect poorly on them[25]. While residents in our study report that their supervisors help with work-related issues and the development of new competencies, they experience poor rewarding behaviors from supervisors.

De Oliveira *et al.* studied the relationship between supervision and medical errors was studied by De Oliveira *et al.*[26]. US-based anesthesiology residents who perceived less supervision reported more medication dose errors and 'performance of procedures they believed not to be properly trained for.' Our data could not reinforce this, which is probably due to the influential factors not included in this study. They reported that 7.5% of anesthesiology residents perform procedures for which they feel not properly trained[26], which is considerably lower than our results on this topic (25%). Possible explanations might include the multitude of specialties included in our study or the Dutch healthcare system, which also relies on residents *not* in training. This prior study did not focus on supervision style, but on frequency. Of course, residents' definitions on 'frequent' supervision may vary considerably, highlighting the importance of open communication with individual residents' needs. More frequent supervision has been shown to increase patient and educational outcomes[27], but supervision is difficult to measure objectively and can also have disadvantages[28]. A knowledge gap regarding residents' needs in terms of supervision frequency and styles still exists.

Implications

This study offers an understanding of residents' perceptions of multiple work-related themes that could be considered difficult to discuss or even *taboo* in the traditional care culture. Therefore, our study yields important insights into a susceptible group in the hierarchy system and the dependence they work in. We provide a starting point for medical training programs to improve young physicians' well-being and patient safety.

First, substantial weekly overtime has become the current norm. Overtime should be registered, confined, and compensated. Especially in surgical specialties, attention to this issue is warranted since an average weekly overtime of up to 14.2 hours per week was reported in this study.

Furthermore, our study highlights the lack of designated supervisors for residents and not training. Training programs should ensure frequent supervision. Since supervisor support scored mediocre and often lacked praise behaviors, the importance of perceived support is increasingly becoming clear from literature across professions, and understanding and catering to residents' supervision needs is key.

Our results indicate that safety climate is perceived as a priority among Dutch residents, but a quarter of residents believe that speed proceeds safely when pressure builds up. The known correlation with medical incidents was reestablished in this study. Simulation training might help understand the rationale behind safety measures and maintain them when working pressure increases, as they have been shown to increase adherence to protocols and comfort in procedures[29].

Finally, many residents experience the feeling of falling short in the care they provide and performing procedures they are not yet adequately trained for, which is a known cause of moral distress in healthcare professionals.

Strengths and limitations

Questionnaire data was, in part, gathered during the global COVID-19 pandemic (from January until April 2020). The first COVID-19 measures were taken on March 15th 2020, by the Dutch government. No differences were found in respondents' answers before and after this specific date. The questions were designed to reflect on the past couple of years of work experience, but it is unclear how these circumstances may have altered responses. Although only one respondent indicated that they work in a COVID-19 ward, it is possible that some respondents' work circumstances have changed with the rearrangement of care due to COVID-19.

Due to the lack of national data on the total number of residents available in the Netherlands, the response rate could not be calculated. The number of residents in specialty training programs was 6800 in 2022[30], and our response was similar to a questionnaire involving mostly residents in training from 2018[8], but these do not include residents not in training and resident researchers (residents who also perform research duties). Sampling bias, specifically non-response bias, could be present in this study due to the social media-based distribution of this questionnaire. It is important to note that there is no feasible alternative for distribution because of the absence of a national resident register. It is possible that residents with negative experiences in the work field were more inclined to respond to the questionnaire call, which may have skewed the results towards more negative views. However, the response was in accordance with a previous national questionnaire[8]. Furthermore, although the questionnaire was anonymous, it is possible that respondents from relatively less common specialties such as ophthalmology and dermatology were hesitant to answer questions about abuse of power or supervisors honestly because they feared public exposure to these issues.

During the analyses, one inaccuracy was observed. The sixth item from the original Medical Errors Questionnaire[16] was not included in the digital questionnaire. A Cronbach's α of 0.634 was calculated to assess the internal consistency of Items 1–5. This demonstrates the reasonable reliability of the composite score without Item 6.

Finally, the questionnaire study was distributed in the Netherlands. Although healthcare systems in Western Europe and the US can be similar in terms of medical education, hierarchy, and organization of care, it is unclear if the findings from this study are generalizable to the US situation. For example, owing to the US national resident matching program, the US is largely unfamiliar with the concept of residents not in training.

Future research

Continued research could focus on exploring residents' *needs* during their medical education or the differences between medical specialties or departments using *learning from excellence* principles. It is conceivable that medical residents' needs and expectations differ according to specialty training, gender, parental status, ableness, or ethnicity.

To address the limitations of structural overtime, gathering insight into the conditions and effects of overtime (e.g., voluntariness, working on a day off, and perceived recognition/appreciation) in our Dutch resident population should be included in future research. To gain insight into the effects of different improvement measures over time (for instance, the implementation of coaching programs and renewed national legal regulations on overtime in 2023), a longitudinal study is needed.

Conclusion

In this study, we showed that overtime is especially abundant among residents. surgical residents and is most often uncompensated. This does not seem to be related to medical errors. Overall, safety climate is perceived as a priority, but one in seven agreed that safety rules and procedures are nothing more than a cover-up for lawsuits, and one in four believes that whenever pressure builds up, speed is preferred over safety. Concerning quality of care and possible addition to moral distress amongst residents, one in four reported that they performed a medical procedure in which they were not properly trained multiple times and sadly, one in three felt they had fallen short in the quality of care on multiple instances. Lastly, supervisor support was mostly present in the development of competencies and work-related problems, but residents reported poor rewarding behaviors, and one in three did not have a designated mentor. Medical training programs should acknowledge the importance of these themes and make tangible efforts to monitor the needs and experiences of residents.

Ethics and consent

The study protocol was approved retrospectively by the Medical Ethics Committee of the University Medical Center, Amsterdam, April 16th 2020 (W20_152#20.191). All participants in this questionnaire agreed to the statement "I hereby agree that the anonymized data will be used in accordance with international guidelines for scientific research" (translated from Dutch) before starting the questionnaire.

Data availability

Underlying data

Zenodo: Medical residents: questionnaire data reporting overtime and perceptions of safety culture, supervisor support and medical errors, a Dutch national study, https://doi.org/10.5281/zenodo.16024559[31]

This project contains the following underlying data:

MedicalResidents_EthicsApproval_ENG.pdf

MedicalResidents_EMvanderLinde2025.sav

Extended data

The dataset can be accessed through data repository Zenodo ("Medical residents: questionnaire data reporting overtime and perceptions of safety culture, supervisor support and medical errors, a Dutch national study", https://doi.org/10.5281/zenodo.16024559) and can be used under a CC-BY4.0 copyright license[31]. This dataset contains the following data: a read me file, an ethics approval summary in English in pdf and the anonymized data as a sav file.

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Open Peer Review

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Version 1

Reviewer Report 19 August 2025

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?

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The work is generally clear in its objectives, methods, and results, and it does reference relevant literature — including both foundational models like the JD-R model and recent studies on overtime, burnout, and safety climate. However:

Some citations are incomplete or inconsistently formatted (e.g., “burnout1”, “stretched system2”), which interrupts clarity and makes it harder to verify sources.

While the introduction draws on relevant and relatively recent literature, certain cited data (e.g., on overtime prevalence) predate the COVID-19 pandemic and may not fully reflect the most current state of research.

A few claims, especially in the background, would benefit from stronger referencing to support general statements (e.g., about the lack of structure in residency or the proportion of residents performing untrained procedures).

The cross-sectional survey design is appropriate for exploring associations between overtime, safety climate, supervisor support, and self-reported medical errors in Dutch medical residents. The use of multiple validated scales (with forward–backward translation) and a reasonably large sample size (n = 492) strengthens the technical robustness. However, there are several limitations that affect the overall technical soundness:

- **Sampling & recruitment bias** – The voluntary online survey distributed via professional networks and social media may have attracted residents with strong opinions or negative experiences, which could skew results.
- **Measurement validity** – For the “medical errors” theme, one item was omitted from the validated scale, and the Cronbach’s α was relatively low (0.634), which weakens internal consistency.
- **Cross-sectional limitations** – The design can only show associations, not causation, yet some interpretations in the discussion lean toward causal implications.
- **Data cleaning choices** – Excluding overtime reports above 29 h/week is reasonable for

plausibility, but it introduces a subjective cutoff that could omit valid extreme cases.
- **Potential self-report bias** – Key variables (errors, overtime, safety climate, supervision) are self-reported and subject to recall or social desirability bias.

The study adds valuable insight into how overtime, safety climate, and supervisor support are associated with self-reported medical errors among Dutch medical residents — a topic with direct implications for patient safety and workforce wellbeing. Its multi-variable approach, use of validated scales, and focus on modifiable workplace factors make it relevant for informing interventions and policy discussions. Despite methodological limitations, it meaningfully contributes to the literature by highlighting potential targets (reducing overtime, improving supervision, fostering a positive safety climate) that could be addressed in future research or practice.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Partly

Have any limitations of the research been acknowledged?
Partly

Are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Health Policy

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.