

Stressforskningsrapport nr 325

Doctors' work hours in Sweden: Their impact on sleep, health, work-family balance, patient care and thoughts about work.

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EXECUTIVE SUMMARY

A representative sample of doctors in Sweden (N = 1534) completed a questionnaire about working conditions, wellbeing and patient care (response rate 53.1%). We examined working time parameters (e.g. having influence over ones' work hours; access to flexitime; shifts longer than 12 hours; short inter-shift intervals - "quick returns"; frequency of on-call duties, night shifts and weekend working; having rest days before and after night shifts; weekly work hours) and a range of outcomes relating to sleep, health, work-family balance, patient care and thoughts about work. The majority of respondents judged their working time arrangements favourably. However, a substantial proportion reported working time arrangements that may not be conducive to effective fatigue management (e.g. short intervals between successive shifts). Doctors working in the specialty areas of ear, nose and throat, orthopaedics, cardiology, surgery and anaesthesia reported some of the most negative attitudes towards work hours. They tended to lack influence over their work hours, and were among the most likely to do a lot of on-call work and / or work frequent long shifts. In the comparisons between regions, respondents in Västra Götaland reported the lowest levels of influence over work hours. Respondents in Uppsala worked the most on-call. Respondents in Northern Sweden reported the highest frequencies of working the whole day before or after a night shift. Respondents in Stockholm worked the fewest hours resident on-call per month and were least likely to work frequent non-resident on-calls. There were few differences in the comparisons of employees in the public and private sectors: public sector workers were more likely to have access to flexitime and were more likely to work non-resident on-call. In the analyses of associations between working time parameters and outcomes, influence over work hours was the strongest predictor of sleep (quantity and quality), health (burnout; stress; fatigue after work; and general health), work-family balance, thoughts about work (attitudes towards work hours; feelings about work; considering changing profession, employer, workplace or type of work) and perceptions of patient care (worrying about making a mistake; risk of malpractice due to workload; continuity of care). Long shifts were associated with insufficient and poorer sleep, negative attitudes and concerns regarding patient safety. Working longer unpaid hours was associated with insufficient and poorer sleep, poorer health (burnout and fatigue), work-family conflict, negative attitudes and concerns regarding patient safety. Long weekly work hours and short inter-shift intervals were both associated with greater likelihood of being reported for malpractice. Weekend working was associated with poorer sleep, poorer health (stress and fatigue), more negative attitudes, reduced patient safety (concerns about workload-related malpractice and likelihood of being reported) and greater work-family conflict. Attitude towards work hours and stress were both highly significant predictors of sleep, health, work-family balance and patient safety outcomes, even after adjusting for the influence of working time parameters. The findings highlight the importance of matching work hours to individual needs and preferences, not only in terms of the impact on psycho-social variables (e.g. satisfaction, work-family balance) but also in promoting positive health and safety outcomes.

Läkares arbetstider i Sverige: Dess påverkan på sömn, hälsa, arbete och familjebalans, patientvård och tankar om arbete.

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Sammanfattning

Ett representativt urval av läkare i Sverige (N = 1534) svarade på en enkät om arbetsvillkor, välbefinnande samt patientvård (svarsfrekvens 53,1%). Vi undersökte arbetstidsparametrar (t.ex. att ha inflytande över sin egen arbetstid; tillgång till flextid, skift längre än 12 timmar, korta intervaller mellan skift, frekvens av jourtjänstgöring, nattskift och helgarbete; med vila dagar före och efter nattskift, veckoarbetstid) och en rad resultat relaterat till sömn, hälsa, balans mellan arbete och familj, patientvård och tankar om arbetet. Majoriteten av deltagarna bedömde sina arbetstidsarrangemang som tillfredställande. Emellertid rapporterade en betydande andel arbetstidsarrangemang som inte främjade effektiv trötthetshantering (t.ex. korta intervall mellan varandra följande skift, begränsade vilomöjligheter omedelbart före och efter nattskift). Läkare inom specialområden såsom öron/näsa/hals, ortopedi, kardiologi, kirurgi och anestesi rapporterade några av de mest negativa attityderna till arbetstiderna. De tenderade att sakna inflytande över sina arbetstider, och var bland dem som mest hade jourarbete och/eller ofta arbetade långa arbetspass. I jämförelser mellan regioner, rapporterade deltagarna i Västra Götaland den lägsta graden av inflytande över arbetstid. Deltagarna i Uppsala hade mest jourtjänstgöring. Deltagarna i norra Sverige rapporterade den högsta frekvensen av att arbeta hela dagen före eller efter ett nattskift. Deltagare i Stockholm arbetade lägsta antalet jourtimmar per månad och var minst benägna att arbeta bakjour. Det fanns få skillnader i jämförelser av anställda i offentlig och privat sektor men: offentliganställda hade oftare tillgång till flextid och arbetade mer bakjour. I analyserna av samband mellan arbetstidsparametrar och hälsovariabler var inflytande över arbetstiden starkaste prediktorn av sömn (kvantitet och kvalitet), hälsa (utbrändhet; stress, trötthet efter jobbet, och allmän hälsa), balans mellan arbete och familj, tankar om arbete (inställning till arbetstid, känslor kring arbete, överväga att byta yrke/arbetsgivare/arbetsplats/typ av arbete) och uppfattningar om patientvården (oroa att göra misstag, risk för felbehandling på grund av arbetsbelastning, kontinuiteten i vården). Långa arbetspass var förknippade med otillräckliga och sämre sömn, negativa attityder och oro vad gäller patientsäkerheten. Att arbeta längre obetalda timmar var förknippad med otillräcklig och sämre sömn, sämre hälsa (utbrändhet och utmattning), arbete-familj konflikt, negativa attityder och oro för patientsäkerheten. Lång arbetsvecka och korta intervall mellan skiften var båda förknippade med ökad risk för rapporterad felbehandling.

Långa arbetstider (inklusive oavlönat arbete) var förknippade med otillräcklighet och dålig sömn, dålig hälsa (utbrändhet och utmattning) och oro för patientsäkerheten. Helgarbete var förknippat med sämre sömn, sämre hälsa (stress och trötthet), mer negativ inställning, minskad patientsäkerhet (oro för arbetsbelastning relaterade till felbehandling och sannolikheten att bli rapporterad) samt större arbete/familjekonflikter. Inställning till arbetstid och stress var båda mycket signifikanta prediktorer

för sömn, hälsa, arbete/familjebalans och patientsäkerhet, även efter justering för påverkan av arbetstidsparametrar. Resultaten visar en omfattande belastning i form av obekväma arbetstider hos läkargruppen och belyser vikten av anpassning av arbetstider till individuella behov och önskemål, inte bara i termer av inverkan på psykosociala variabler (t.ex. tillfredsställelse, arbete/familj balans) utan också vad gäller främjande av hälsa och säkerhet.

INTRODUCTION & LITERATURE REVIEW

Doctors working in industrialised countries have traditionally worked long hours, particularly during the early stages of their career, with 24-hour on-call shifts and 100-hour working weeks commonly reported. Moreover their schedules often featured frequent overnight and on-call duties. Historically, such schedules have been seen as an essential feature of junior doctors' training, underpinned by the need to experience first hand exposure to a wide variety of patient cases. Such a regime ensures that trainees develop the ability to recognise the impact of their interventions over time and obtain practice in independent decision-making. As such the demanding work hours undertaken have been described as a 'rite of passage' and a necessary part of junior doctors' need to 'toughen up' (Jagsi et al., 2005).

Rising expectations within society and the media have lead to increasing demands being placed upon the health care system and medical professionals. At the same time, contemporary society has become less tolerant of medical errors (Shirom, Nirel, & Vinokur, 2006). This has lead to concerns about standards of patient care and about the exploitation of doctors who have to make critical decisions, while working under constant time pressure and with inadequate rest opportunity (Scallan, 2003). Over recent years there has been a gradual recognition that the stressful working environment faced by doctors is not conducive to successful medical practice or to the reduction of medical errors (Holmes, 1998). There is a growing recognition in both academic and political domains that the hours worked by doctors are unacceptable, with respect to the welfare of doctors and the patients they treat. Research has shown that the long hours worked by doctors negatively impact on their sleep, on-duty fatigue, eating habits and their ability to maintain a healthy work life balance (e.g. Nocera & Khursandi, 1998).

Such findings underlie moves towards the regulation of doctors' working conditions within Europe, in the form of the European Working Time Directive (EWTD: "Council Directive 93/104/EC," 1993). The directive stipulates limits such as maximum weekly work hours, maximum quantity of night work and the minimum amount of rest opportunities (e.g. rest during and between shifts, days off per week and weeks of annual leave).

Studies of doctors in Sweden are rare and so the literature review follows focuses primarily on studies conducted in the United States, Europe and Australia.

Sleep deprivation & performance

The literature documents a wide variety of implications for work performance within the medical profession arising from fatigue. However the situation is complicated by issues such as the potential trade-off between continuity of care and decreased fatigue (Fletcher et al., 2004).

Physicians undertaking night call work experience substantial sleep deficits (Åkerstedt, Arnetz, & Anderzén, 1990) which can result in impaired job performance. In an early study, Friedman et al (1971) demonstrated impaired performance scores of sleep deprived physicians on an electrocardiogram interpretation task. Pilcher (1996) reported that sleep loss in trainee doctors (i.e. less than 5 hours of sleep per night) significantly reduced cognitive performance and mood. Saxena & George (2005) reported a Canadian field study in which trainee doctors working on-call were found to

get less sleep and showed impaired reaction time and reduced vigilance, compared to an equivalent group who were not on-call. A meta-analytic study concluded that cognitive performance in physicians is reduced as a result of fatigue and sleep loss associated with extended work hours (Philibert, 2005).

Arnedt et al (2005) provided further support of the effects of fatigue on performance in an examination of training related post call performance impairment in an intervention study of paediatric residents in the US. Measures of sustained attention, vigilance, simulated driving, self report sleepiness, performance and effort measurements were examined under four different conditions; light call (defined as a day rotation averaging 44 hours a week without night call duties), light call with alcohol, heavy call (defined as a rotation averaging 90 hours per week and night call every fourth or fifth night) and heavy call with placebo. They found that impairment following heavy call rotation was comparable with impairment due to a blood alcohol level of 0.04-0.05 g% during light call rotation (by comparison, 0.02 g% is the legal limit for driving in Sweden).

Survey research indicates that the effects of long work hours are a major source of concern for doctors in training. Jaggi & Surender (2004) reported findings of a questionnaire survey undertaken in America and the UK and followed up with 32 in-depth interviews with junior doctors who had completed the original questionnaire. They reported that 72% of respondents agreed that junior doctors' hours were too long and that they had a detrimental effect on patient care (e.g. increased incidence of mistakes and errors, reduced efficiency and reduced ability of junior doctors to relate to their patients).

The above findings suggest that extended shifts in which doctors are continuously on-call are major cause of sleep deprivation and therefore are a potential source of medical error. A recent systematic review reported that the reduction of shifts over 16 hours was associated with improvements in patient safety, as well as doctors' quality of life, in most studies (Levine, Adusumilli, & Landrigan, 2010). For example, an intervention involving the total elimination of extended shifts (≤ 24 hours) resulted not only in doctors getting more sleep, but also experiencing fewer attentional failures (i.e. microsleeps) and committing fewer medical errors (Landrigan et al., 2004; Lockley et al., 2004).

It important to note that impact on patient care may be crucially dependent on the particular arrangements that are put in place in order to bring about the reduction in work hours. For example, a small number of early studies anticipated the move away from extended on-call shifts by examining 'night-float' systems in which one or more doctors are assigned to night duties, with little or no daytime responsibilities. Griffith et al (1997) compared night-float systems with conventional systems in which house staff worked very long shifts including nights on-call. Night-floats were associated with decreased continuity of patient care, with doctors spending less time with patients because they were not required to spend the night on-call, leading to decreased patient satisfaction. A separate comparison of primary team (the patients usual care team), cross-coverage (care by doctors who were not members of the patient's usual care team) and a night-float system found that while primary team cover had significantly fewer adverse effects, the cross coverage system was associated with increased risk to patient care (Petersen, Brennan, O'Neil, Cook, & Lee, 1994).

Another means of managing night-time fatigue was studied by Arora (2006) who reported on the introduction of a night time nap schedule which increased sleep efficiency and decreased fatigue among interns, although concerns for continuity of care meant that junior doctors took limited advantage of the opportunity to nap.

In the UK, the implementation of the EWTD has resulted in new working time arrangements that are more similar to traditional shift working i.e. schedules made up of a combination of separate day shifts and night shifts. One of the first studies to examine such schedules was an intervention study, which examined the impact of reducing the length of the working week to 48 hours on medical errors among a team of nine British doctors (Cappuccio et al., 2009). Compared to 'traditional' 56-hour workweeks, the intervention schedule involved working shorter shifts (maximum 12 hours; average 9 hours i.e. 0.9 hours shorter the traditional schedule), with a maximum of three nights in a row. Instead of alternating between day and nightshifts, participants on the intervention schedule worked a sequence of morning, evening and night shift in a schedule designed to facilitate gradual circadian adaptation to night working. The sequence also allowed for longer recovery sleeps after evening shifts (in preparation for nightshifts). Intervention participants were also encouraged to nap during the day before the nightshift. The intervention schedule was associated with a 33% reduction in medical errors. However, intervention participants also complained of compromised educational opportunities, with less time for interaction with colleagues and less chance of feedback on performance. Concerns about the impact of shorter shifts on patient care were also highlighted in an earlier study of house surgeons in which participants experienced increased anxiety associated with disruption of duty and patient care following the introduction of shorter shifts (Hale et al., 1995). Cappuccio et al noted that such negative findings emphasise the need to ensure that changes to work schedules are synchronized with normal hospital practises and that they are adequately resourced.

A recent survey in Wales identified several aspects of junior doctors' working time arrangements that impacted on fatigue (Tucker et al., 2010). Working 7 consecutive nights was associated with greater accumulated fatigue on the night shift, compared with working just 3 or 4 nights. Having only a single rest day after working nights was also associated with greater fatigue on the subsequent day shift. Inter-shift intervals of <10 hours were associated with shorter sleeps and greater fatigue. The number of hours worked per week was positively associated with fatigue on night shifts. In a related study (Brown et al., 2010), doctors also expressed concerns about the impact of long shift sequences (i.e. 12 consecutive days shifts) on fatigue, alertness and concentration, increased errors, reduced work speed and impaired information processing.

The findings of Cappuccio et al, Tucker et al and Brown et al highlight the fact that many aspects of shift system design, besides length of work hours, influence fatigue. Baldwin & Daugherty (2004) drew similar conclusions from their questionnaire survey of American doctors in training. They found that the association between work hours and sleep length, though significant, was not as robust as might have been expected. They also noted that the strength of the association between work hours and sleep hours will depend on whether doctors are able to sleep during their duty hours, as well as other non-work factors (e.g. individual differences in sleep need and domestic circumstances). Gander et al (2007) evaluated work patterns of New Zealand junior doctors in relation to fatigue in a questionnaire survey. Excessive work hours were identified as an independent risk factor for excessive sleepiness, with 30% of respondents scoring excessively highly on the Epworth Sleepiness

Scale (i.e. twice the prevalence of the general population). However, the authors concluded that other factors besides total work hours should also be taken into consideration when seeking to manage fatigue e.g. regularity of the work schedule and adequate access to supervision whilst at work. They also identified night work as an independent risk factor for excessive sleepiness, feeling sleepy at the wheel and for clinical error, with 42% reporting clinical error in the previous six months. Similarly, Ferguson et al (2010) reported that in their study of Australian doctors, while more hours of work were related to fewer hours of sleep, sleep length was also influenced by the pattern of work (e.g. long shifts, night duties) and other non-work factors.

Training

Sleep loss and fatigue may negatively impact upon trainee doctors' learning ability, professionalism and professional development (Papp et al., 2004). However, there is also a commonly held concern that reductions in work hours may have negative effects on doctors' training, particularly in relation to on-the-job experience (Brown, et al., 2010). A survey of Senior House Officers, Specialist Registrars and Consultant surgeons in Wales concluded that "... the vast majority of surgical trainees in Wales oppose the EWTD, believing it will have a detrimental effect on training, patient care and doctors lives outside of medicine" (Morris-Stiff, Sarasin, Edwards, Lewis, & Lewis, 2005). Stephens (2004) also reported that training opportunities had been significantly reduced since the implementation of the EWTD in the UK, for example with elective operative experience being reduced by one third and experience as a primary surgeon reducing four fold. It has been reported that in Sweden between 1992 and 2010, while proportion of doctors working more than 40 hours per week reduced, the amount of time that doctors devote to advancement of knowledge also declined (Bejerot, Aronsson, Hans, & Bejerot, 2011). Conversely, the reduction of shifts over 16 hours in the US has not adversely affected doctors' education, according to a recent systematic review (Levine, et al., 2010).

Shiftwork & Health

Smith et al (2006) studied the hormonal and psychological effects of a full shift rota on a population of junior doctors following EWTD implementation, in a comparative, cross sectional study of male doctors in England. Their findings suggested that negative physiological consequences of shiftwork remained under the new work patterns, with well-being and mental health scores deteriorating following a week of night shifts. A study of physicians in Finland showed that the co-occurrence of high levels of on-call work (> 40 hours per month) and lifestyle risk factors (e.g. smoking, heavy drinking, overweight, low physical activity) resulted in increased distress and increased intention to quit (Heponiemi et al., 2008). The previously mentioned study of junior doctors in Wales found that working frequent on-call duties was associated with increased psychological strain (Brown, et al., 2010; Tucker, et al., 2010).

Life outside work

Shiftworking is commonly associated with a disruption of life outside work. In a review, Wilson (2002) reported that shiftworkers in health care settings often felt isolated from their family and social commitments, and that they were unable to fulfil domestic roles, resulting in low self esteem and increased anxiety. Similarly, in their interviews with junior doctors, Jagsi & Surender (2004) reported that participants felt that fatigue and anti-social schedules impaired their ability to participate in social activities. They also reported negative effects on well-being as a result of poor diet, depressed mood, compromised personal relationships, maladaptive habits including binge drinking and decre-

ased exercise. It was also noted that the negative effects of long hours appeared to be magnified for females, due in part to the traditional social expectations of women baring primary responsibility for child care and other domestic responsibilities.

In their study of junior doctors in Wales, Brown et al (2010) reported that doctors experienced difficulty maintaining a balance between the desire for a successful medical career and their home-life commitments and that personal needs were frequently pushed aside in favour of professional commitments. In the corresponding survey (Tucker, et al., 2010), it was reported that greater work-life interference was associated with working a weekend on-call between two consecutive work weeks, working frequent on-calls (either weekends or during the week) and long weekly work hours. There was mixed evidence regarding the impact of working several successive night shifts. Some interviewees felt that working only 3 or 4 consecutive nights (as opposed to 7) was more disruptive of life outside work (Brown, et al., 2010), but in the corresponding survey shorter sequences of nights were associated with greater disruption of life outside work (Tucker, et al., 2010).

Individual and situational factors

In their study of Australian physicians, Ferguson et al (2010) reported that surgery-related specialities worked more hours than medical specialities. Compared to doctors working in medium sized facilities, doctors in large and small facilities recorded fewer days off, and more overnight and weekend on-call duties. Senior doctors and mid-career doctors were more likely to work on-call duties than junior doctors. Senior doctors obtained the same amount of sleep whether or not they had been scheduled to work during the previous day, in contrast to junior and mid-career doctors who sleep more on their days off. This was ascribed to senior doctors effectively being continuously on-call, being required to supervise registrars and juniors and / or holding very senior hospital management roles. A number of studies have focussed specifically on fatigue among anaesthetists. A Swedish study examined sleep and recovery among two groups of physicians working 16 hour night calls, comparing anaesthetists with other physician specialists handling less life threatening conditions when on-call (Malmberg et al., 2010). They found that in both groups, recovery was achieved after two nights sleep.

The current study

An earlier publication, based partly on data from the current study, indicated that the work environment of doctors in Sweden became significantly worse between 1992 and 2010 (Bejerot, et al., 2011). However, that publication did not consider the impact of working time arrangements in any detail. The above review has highlighted the importance of shift system design in the management of doctors' fatigue and related outcomes. Therefore one of the primary aims of the current study will be to explore the types of work schedules in operation in Sweden. It will also build upon earlier work that has examined the effects of shift system design (Brown, et al., 2010; Tucker, et al., 2010) by examining additional parameters (e.g. control over working time), using a set of a broader set of outcome measures. The aim of the study is to identify which aspects of doctor's working time arrangements are the most important predictors of sleep, health, work-family balance, patient care and attitudes towards work.

METHOD

In 2007, a questionnaire was sent to 3000 Swedish physicians (almost 10 % of all physicians in Sweden), selected at random from the membership of the Swedish Medical Association. We received 1534 responses. Analysis of non-responders indicated that 109 were not active physicians, giving a final response rate of 53.1%. The response rate was higher for females (56.6%) than for males (49.8%). The regional ethics committee approved the questionnaire. (See appendix 1 for details of questionnaire items used in the current study).

The questionnaire began with a series of background questions regarding the respondents' biographical details, and the nature and location of their current job. Additionally, it included a range of items concerning working time arrangements. All respondents were asked about the degree of influence they had over their work hours; their access to flexitime; the number of weekly work hours; the number of unpaid weekly work hours; and whether they worked only ordinary hours (weekdays 06-21) or a mix of ordinary hours and on-call. Those who worked on-call were asked questions regarding frequency of shifts longer than 12 hours; frequency of short inter-shift intervals - "quick returns" (< 11 hours and < 8 hours); frequency of resident on-call duties; frequency of night shifts; frequency of weekend days that are worked; frequency of night duties; number of resident on-call hours per month; proportion of night duty being active work; how much of the day before a night shift is worked; how much of the day after a night shift is worked; frequency of being non-resident on-call; frequency of being called during non-resident on-call; and the number of weekends per month that are completely free.

The questionnaire also contained items relating to sleep, health, work-family balance, patient care and thoughts about work, as follows. Six measures of sleep were obtained. The first outcome was an index of disturbed sleep, based on items from the Karolinska Sleep Questionnaire (Åkerstedt, Ingre, Broman, & Kecklund, 2008; Åkerstedt et al., 2002). This was calculated as the mean score of responses to four items which asked participants how often they had experienced each of the following sleep symptoms in the last three months: difficulty falling asleep, repeated awakenings with difficulty falling back to sleep, too early (final) awakening and interrupted / restless sleep (range of possible scores: 1 – Never; 6 – Always / 5 times or more per week). Responses to three additional items regarding sleep symptoms were analysed separately. These were a Feeling of being exhausted when waking up, Short sleep (<6 hours), Difficulty sleeping due to thoughts about work (range of possible scores: 1 – Never; 6 – Always / 5 times or more per week). The fifth and sixth outcomes were responses to the questions 'Do you think you get enough sleep?' (1 – Yes definitely enough; 5 – No, far from enough) and 'How would you rate your sleep in general?' (1 – Very good; 5 – Very poor).

There were six outcomes related to wellbeing. Emotional exhaustion was based on 5 items from the Maslach Burnout Inventory (Maslach, Schaufeli, & Leiter, 2001) asking how often the symptom has been experienced (1 – every day; 7 - never). Stress was assessed using the measure of long lasting stress described by Hasson et al (2011). The original scale comprised 7 items asking how the respondent has felt in the last three months (1 - Not at all; 4 - almost all of the time). For the purposes of the current analyses, stress was assessed using only the first three items of this scale. Fatigue after work was based on 3 items (selected from a 7 item scale entitled 'fatigue & health'), regarding

frequency of symptoms (1 yes, often; 5 – almost never). General health was based on a single item (1- Very good; 5 – Very poor). Work ability was based on a single item (1 – cannot work at all; 10 – My working ability has never been better). Work-family conflict was assessed with the item ‘How well can you combine work and family responsibilities?’ (1 –Very well; 4 – Not at all).

There were three outcomes related to attitudes. The first was ‘What are your feelings about work when you are on the way there?’ (1 - I feel very happy and satisfied with the idea of the work that awaits; 5 – I feel a strong dislike of my work). The second was ‘What do you feel about your work hours?’ (1 – Very positive; 5 – Very negative). The third outcome variable was based on 5 items that asked whether respondents had considered in the last year changing profession, employer, workplace, specialism or involvement in direct patient care. The variable was calculated as the total number of ‘yes’ responses to items asking about having thought about changing each of these aspects of the current situation.

There were four variables relating to patient care. The first asked ‘Do you ever feel the risk of making mistakes in your work as a mental stress?’ (1 – No, never; 5 – Yes, constantly). The second asked ‘How often do you have a workload that you feel increases the risk of malpractice?’ (1 – Daily; 4 – Less often). The third asked ‘During the past 5 years, have you ever been reported in your work?’ (1 – No; 4 – More than three times). The fourth asked ‘Do you have continuity in your patient work, from diagnosis to treatment and further follow-up?’ (1 – Far too little; 5 - Far too much).

RESULTS

These analyses begin with a description of the working time arrangements of the whole sample. This followed by cross-tabulation analyses (Chi-square) that examine working time arrangements, broken down by medical specialty, geographic region and type of employer (public versus private sector). Finally, a series of regression analyses examine the associations between working time arrangements and outcome measures.

For the purposes of the cross-tabulation analyses, response categories for the working time arrangement variables were aggregated, as follows: ‘What do you feel about your work hours?’ aggregated into ‘positive or neutral attitudes’ and ‘negative attitudes’; ‘influence over work hours’ and ‘access to flexitime’ aggregated into ‘yes, or yes to some extent’ and ‘no’; ‘shifts longer than 12 hours’, ‘quick return less than 11 hours’, ‘quick return less than 8 hours’, ‘frequency of weekend duty’ and ‘frequency of night duty’ aggregated into ‘never’, ‘1-4 times per month’ and ‘5 or more times per month’; frequency of non-resident on-calls aggregated into ‘never’, ‘1-4 days/month’ and ‘5 or more days per month’; number of completely free weekends aggregated into ‘all weekends’, ‘3 weekends per month’ and ‘2 or fewer weekends per month’; working before / after a night shift aggregated into ‘completely free / I work half day or less’ and ‘no, I work a whole day’.

Working time arrangements of the sample as a whole

Two thirds (64%) of the respondents expressed a positive attitude (either ‘rather’ or ‘very’ positive) towards their work hours, while 12.6% indicated quite negative or very negative attitudes towards their work hours (see Figure 1). A similar proportion (67%) indicated that they had at least some degree of influence over their work hours (see Figure 2), while three quarters (73%) reported having at least some degree of flexitime (see Figure 3). Respondents worked an average of 39.4 hours (SD = 7.3) per week. They reported undertaking an average of 5.1 hours of unpaid work each week, although the variability was high (SD = 8.0).

Figure 1: ‘What do you feel about your work hours?’ (Whole sample).

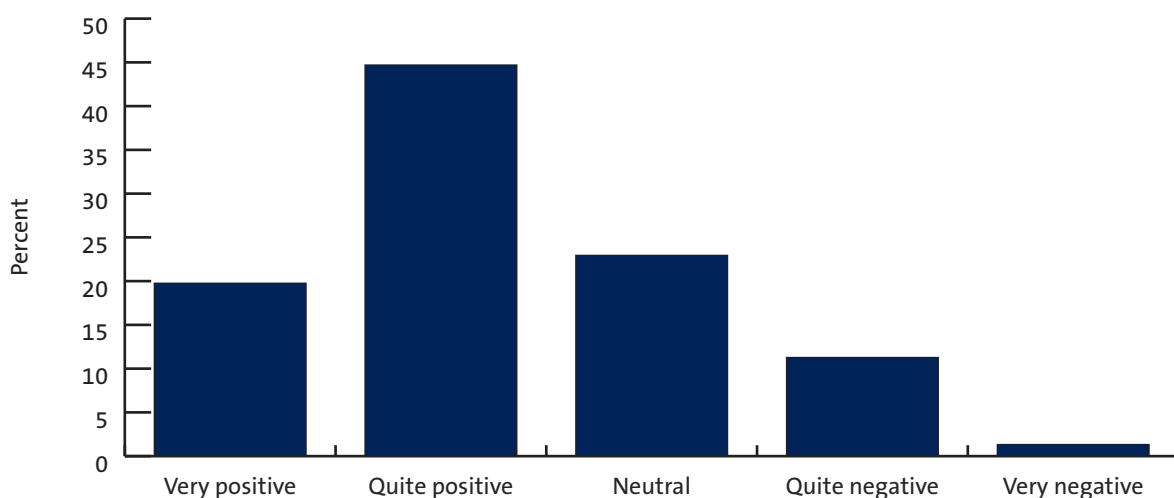


Figure 2: ‘Can you influence how and when your work hours are scheduled?’
(Whole sample)

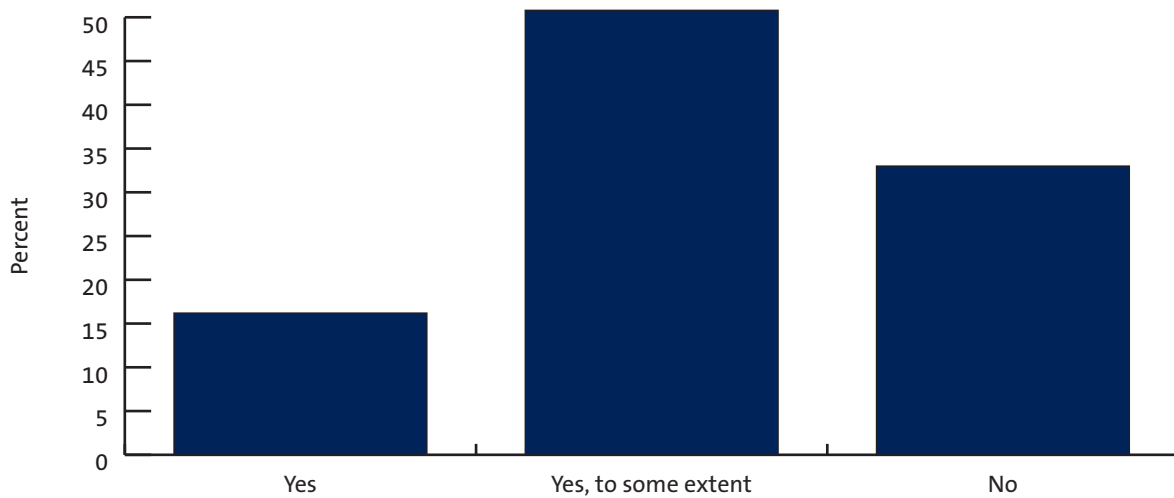
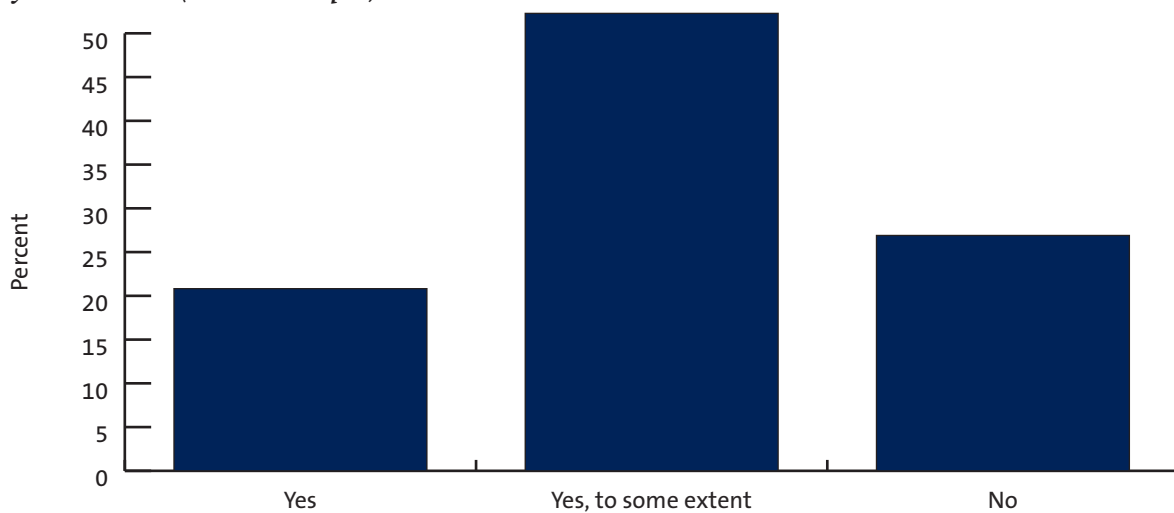


Figure 3: ‘Do you have some form of flexitime, which means you can adapt your working time to suit your needs?’ (Whole sample)



Two thirds (65%) of respondents reported working some form of non-standard hours (i.e. outside 06-21 weekdays) that included resident on-call duty or being on stand-by (non-resident on-call). Within that subsample, 16.2% indicated quite negative or very negative attitudes towards their work hours. This is significantly higher ($p < .05$, *Fishers' exact test*) than the 13.4% of respondents in a large representative sample of shift workers in Sweden (Åkerstedt, Ingre, & Kecklund, 2012) who expressed quite negative or very attitudes towards their work hours. Among those who worked non-standard hours in the current sample, 38.7% indicated that they had no influence over their work hours. This is also significantly higher ($p < .001$) than the 25.4% of respondents in the representative sample of Swedish shift workers who reported having no influence over their work hours.

Among those working non-standard hours, 18% reported working shifts longer than 12 hours at least 5 times per month i.e. once a week on average (see Figure 4). More crucially, a large proportion (89%) reported having an interval of less than 11 hours (the minimum permitted by the EWTD) between shifts at least once a month (see Figure 5). More than one third (38%) said they had an interval of less than 8 hours between shifts at least once a month (see Figure 6).

Figure 4: ‘How often are your shifts longer than 12 hours in total (including any on-call duty)?’
(Sub-sample working non-standard hours)

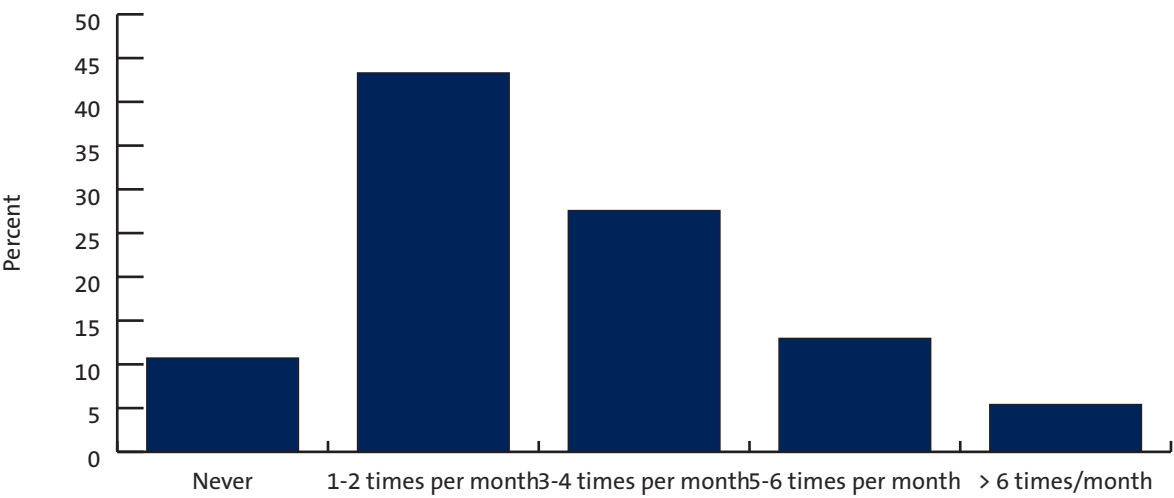


Figure 5: ‘How often is the time off (leave) between your shifts (including any on-call duty) less than 11 hours?’ (Sub-sample working non-standard hours)

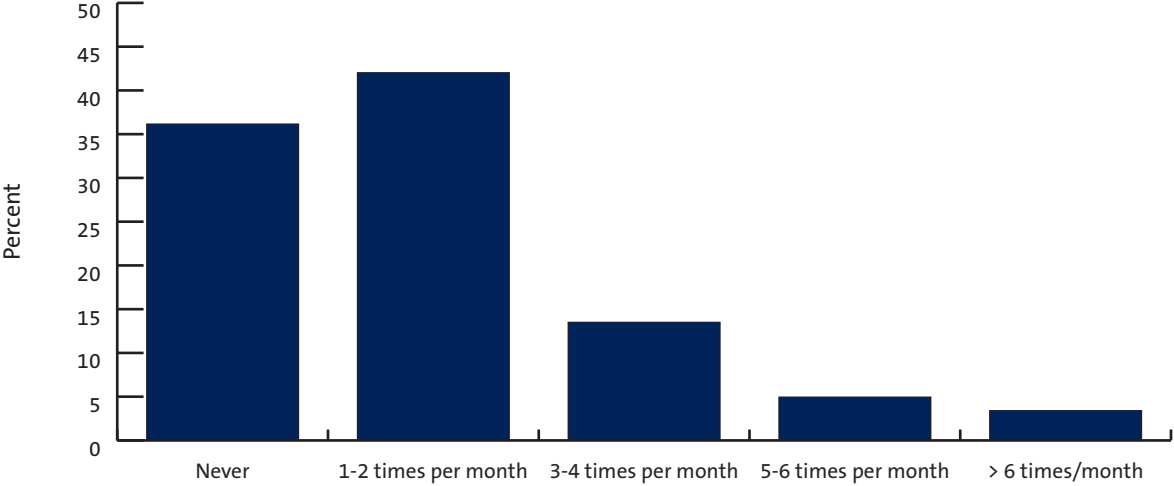
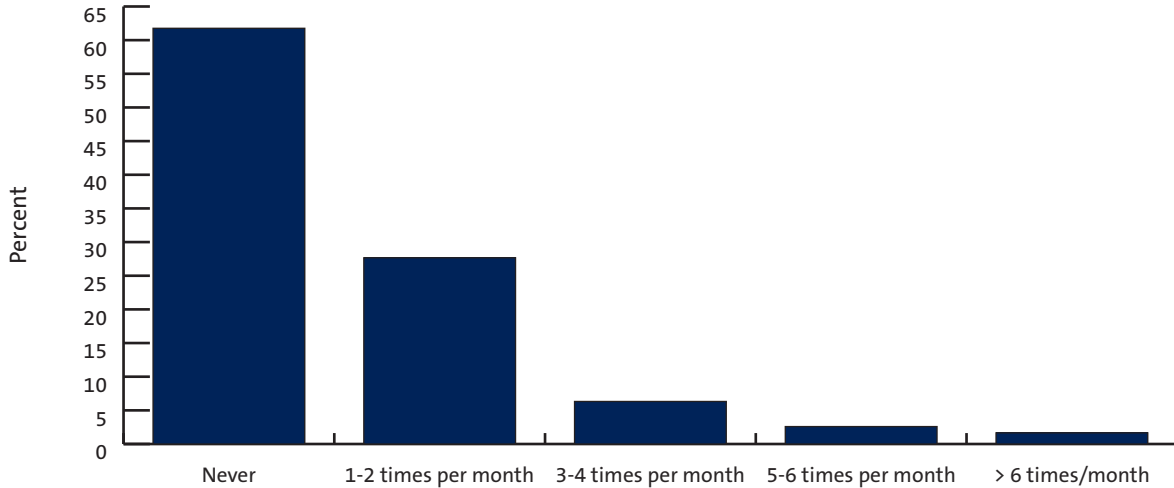


Figure 6: ‘How often is the time off (leave) between your shifts (including any on-call duty) less than 8 hours?’ (Sub-sample working non-standard hours)



Respondents who worked resident on-call (at least one hour per month) worked an average of 40.9 hours resident on-call per month, although the variability was high ($SD = 29$). Ninety two per cent of those who worked non-standard hours worked weekends (resident on-call) at least once per month (see Figure 7). Seventy per cent worked nights (resident on-call) at least once a month (see Figure 8), with 29% actively working throughout the entire night shift, or most of it (see Figure 9). Notably, from a fatigue management perspective, 52% reported working the entire day immediately before a night shift (see Figure 10) and one third (34%) worked the entire day following a night shift (see Figure 11). However, those who more frequently worked the whole day before or after night shifts tended to work night shifts only relatively infrequently. Moreover, 90% of those working a whole day before a shift, and 97% of those working a whole day after night shift, indicated that only half of the night shift or less was active work. In other words, the vast majority of those working the whole day before or after a night shift had relatively light workloads during the night, with frequent opportunities for rest during the night shift.

Figure 7: ‘How often do you work weekends on-call duty (days)?’ (Sub-sample working non-standard hours)

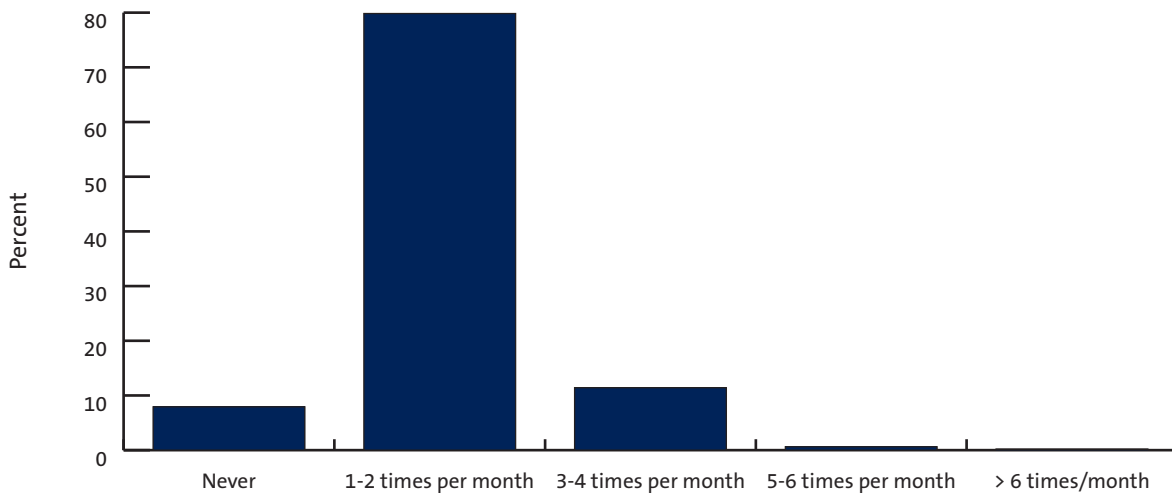


Figure 8: ‘How often do you work night duty?’ (Sub-sample working non-standard hours)

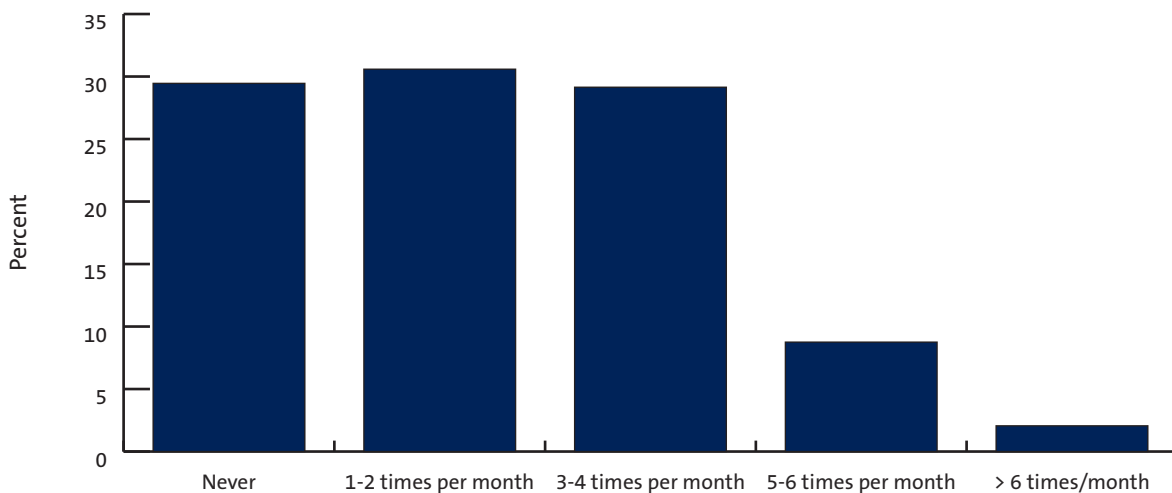


Figure 9: ‘How much of a night duty is active work?’
(Sub-sample working non-standard hours)

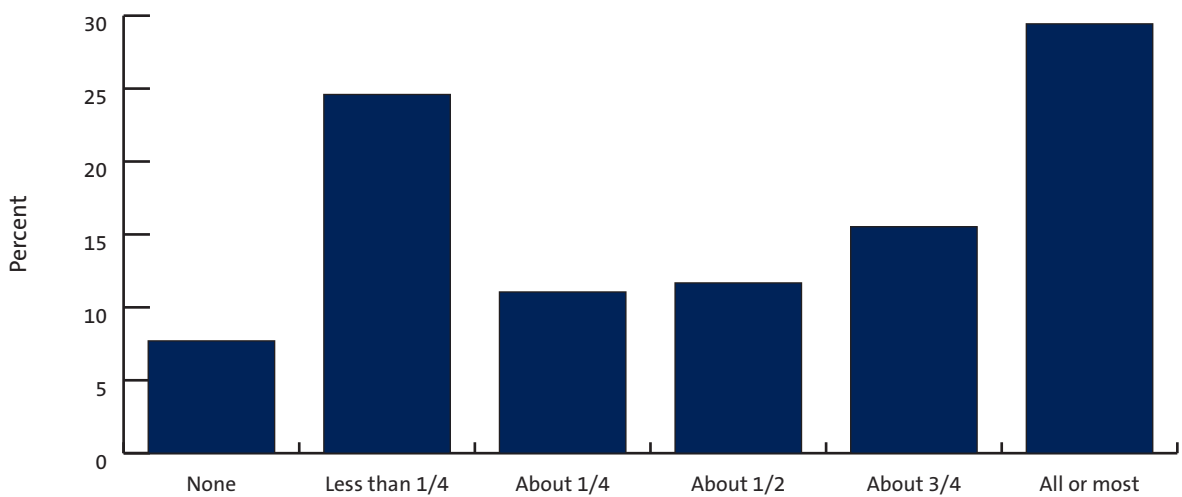


Figure 10: ‘Are you generally free directly before a night shift?’
(Sub-sample working non-standard hours)

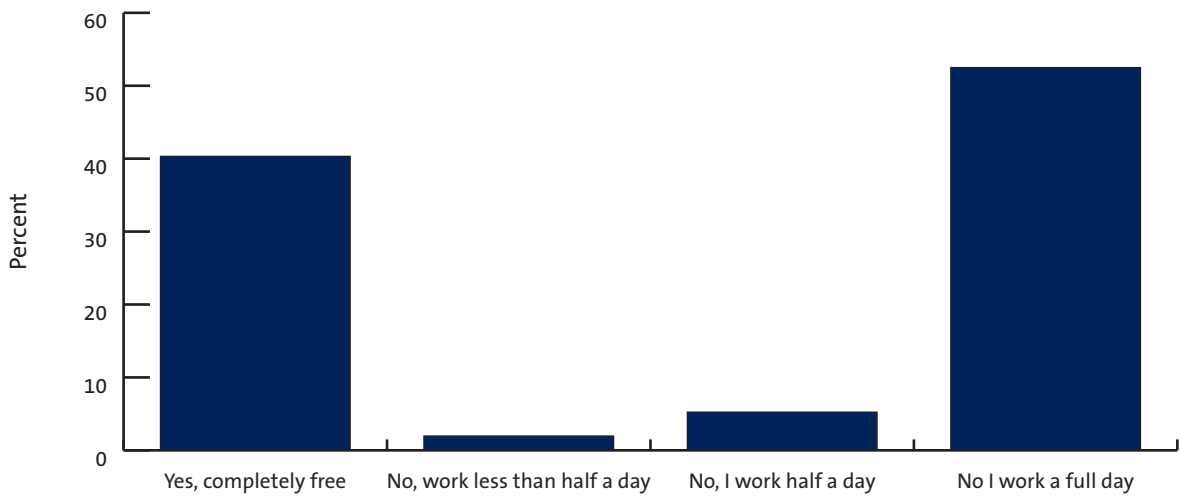
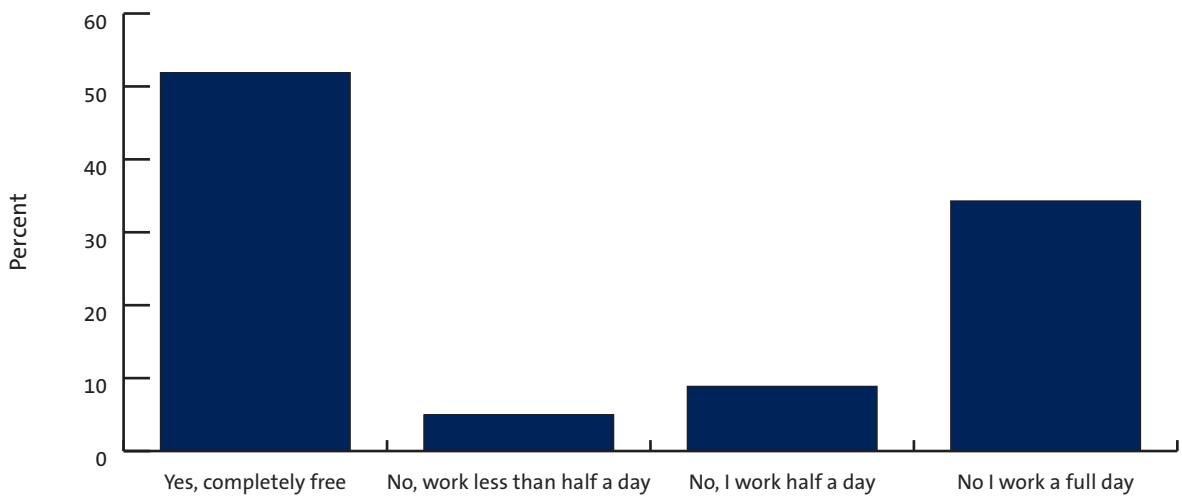


Figure 11: ‘Are you generally free directly after a night shift?’
(Sub-sample working non-standard hours)



More than half of respondents who worked non-standard hours (58%) reported working non-resident on-call (see Figure 12). The median frequency of being contacted during a non-resident on-call duty was 2 – 3 times, with 97% being called at least once (see Figure 13).

*Figure 12: ‘How often are you on-call (non-resident) on average?’
(Sub-sample working non-standard hours)*

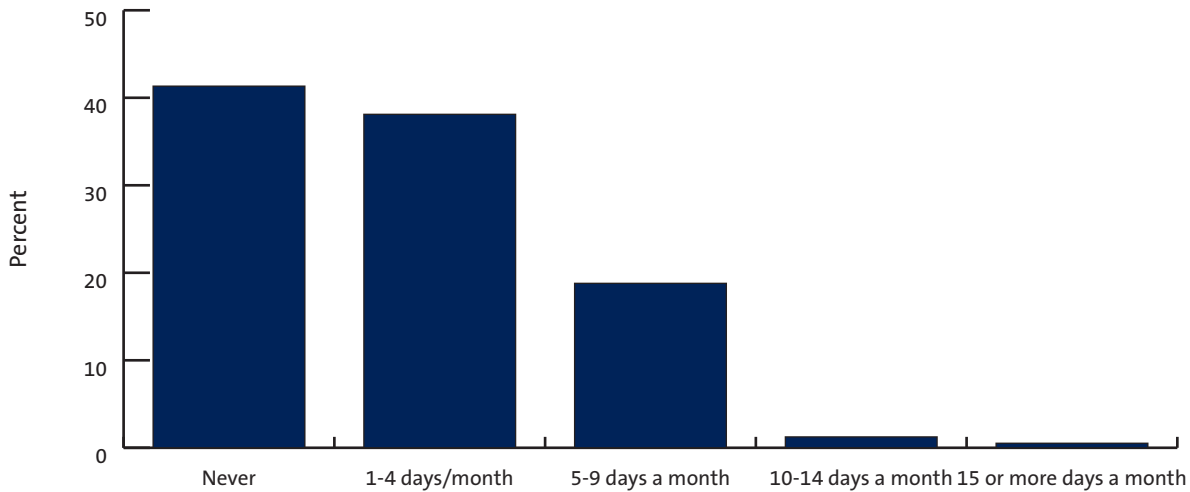
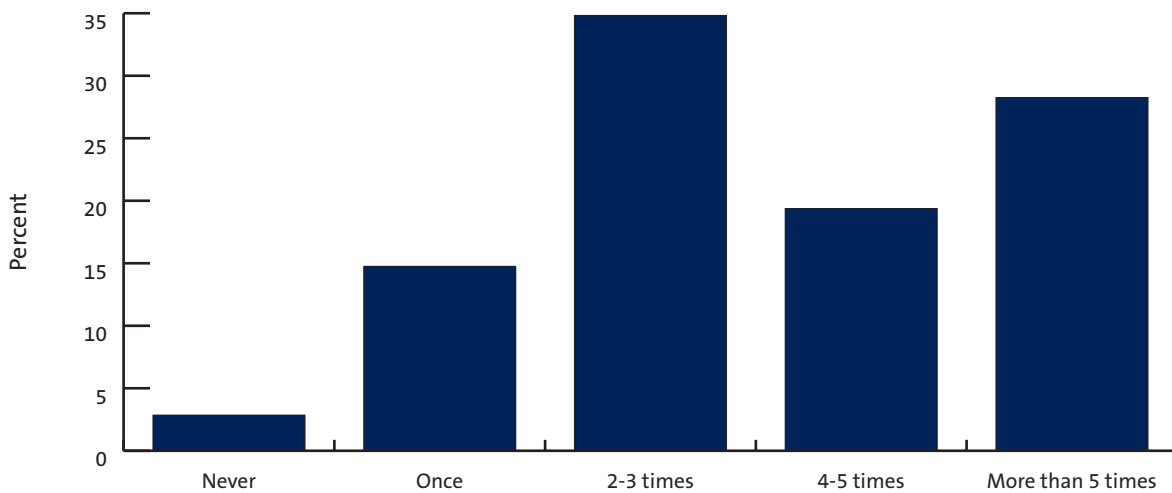
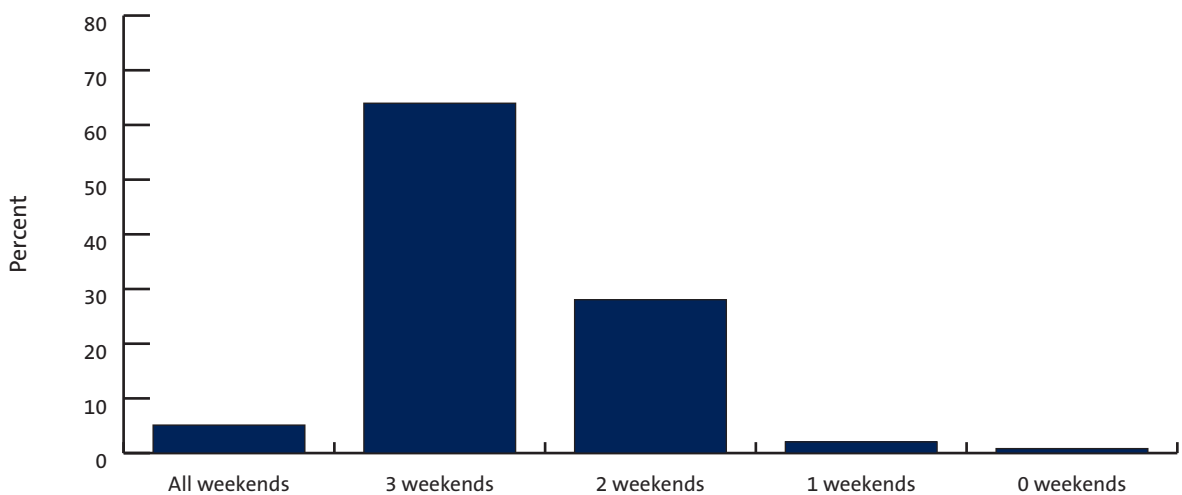


Figure 13: ‘How often will you be called during non-resident on-call, on average per day?’ (Sub-sample working non-standard hours)



Nearly one third (31%) of the respondents who worked non-standard hours (either resident or non-resident on-call) reported having only two completely free weekends, or less, each month (see Figure 14).

Figure 14: ‘How many weekends per month are you completely free (both Saturday & Sunday)?’
(Sub-sample working non-standard hours)



Half (50%) of all respondents indicated that they did not feel they got sufficient sleep, while 16% described their sleep on the whole as ‘rather poor’ or ‘very poor’ (see Figure 15). Eighty per cent reported experiencing at least one sleep problem, at least once a week.

Figure 15: Do you think that you get enough sleep? (Whole sample)

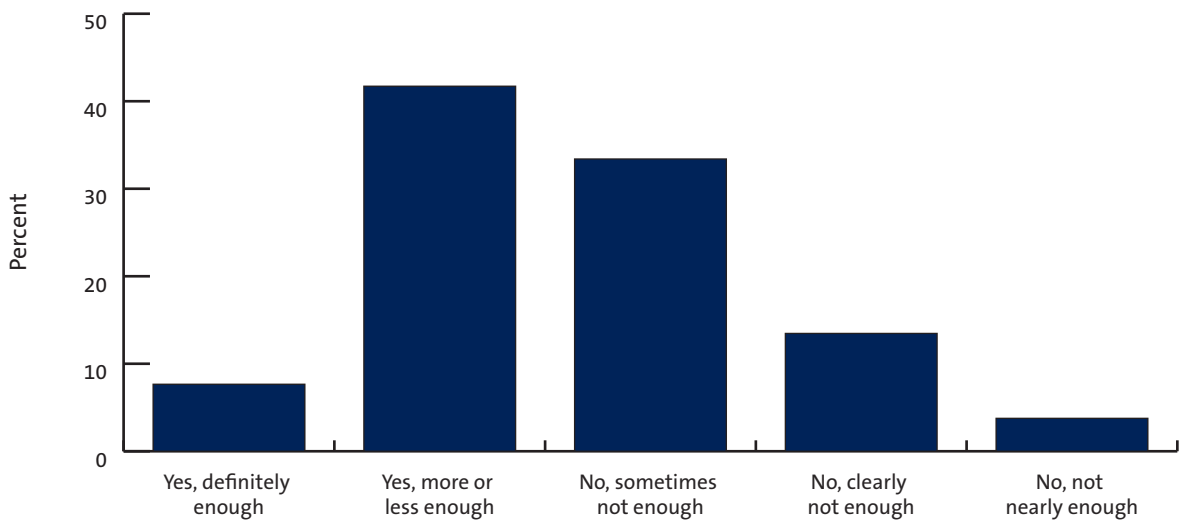
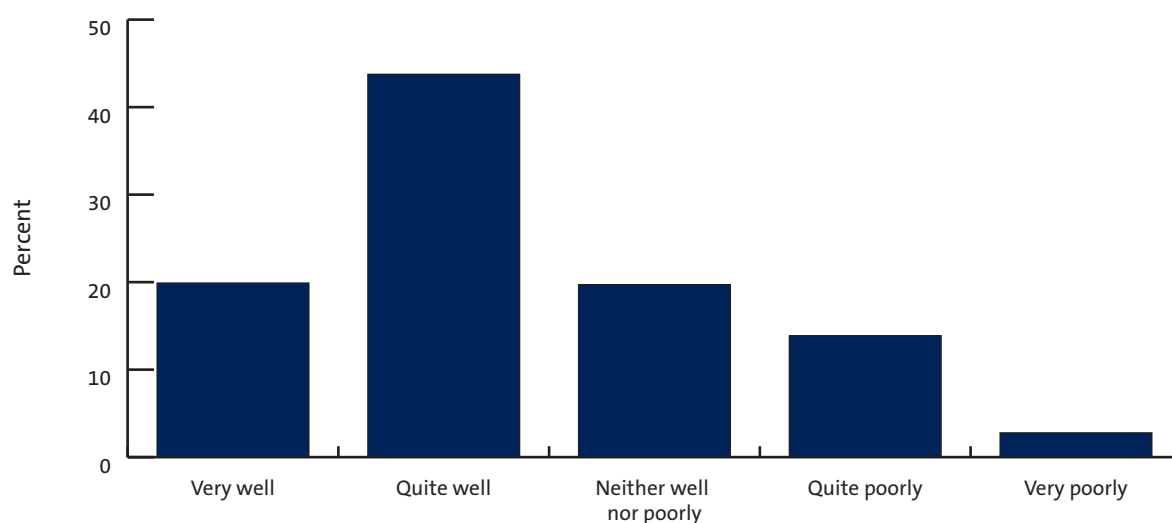


Figure 16: 'How do you feel you are sleeping on the whole?' (Whole sample)

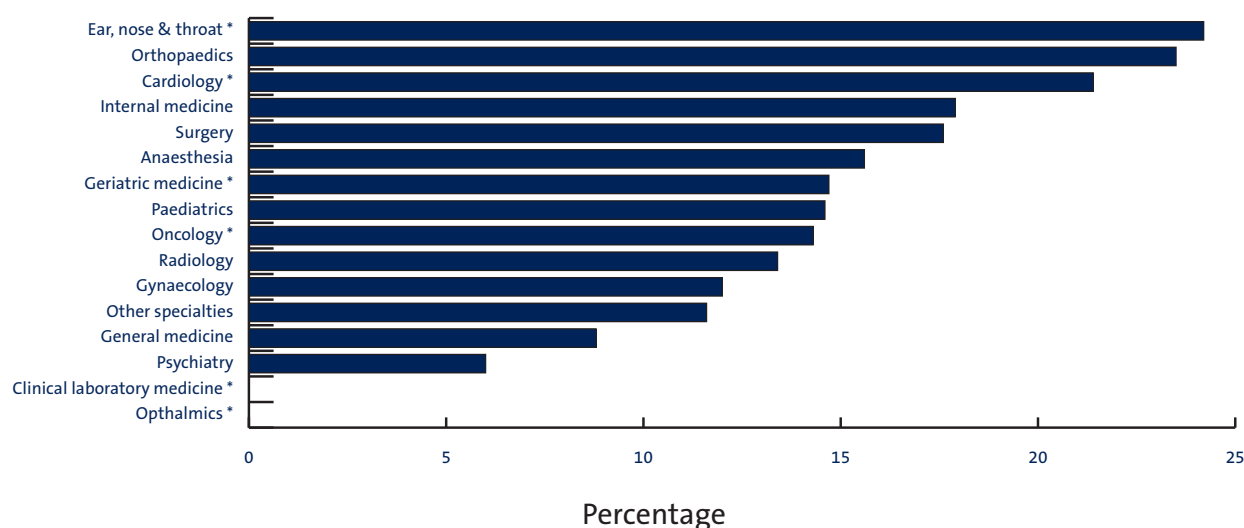


Broken down by specialty

The figures that follow present the responses to each item about working time arrangements, broken down into 16 categories of medical specialty (including a category 'other specialties'). It should be noted that there were relatively few respondents (i.e. $N < 40$) from the specialties of Cardiology, Geriatric medicine, Clinical laboratory medicine, Oncology, Ophthalmology and Ear, nose & throat (ENT). Therefore data relating to those six specialties should be interpreted with caution (denoted * in the figures below). For the purposes of the accompanying chi-squared analyses, in order to maximize statistical reliability of the results, respondents from those six specialties were aggregated into the category 'other specialties' (i.e. giving a total of 10 categories of medical specialty).

ENT and Orthopaedics had most negative attitudes towards work hours (24% and 23.5% respectively were rather negative or very negative), followed by Cardiology (21.4%), Internal medicine (17.9%) and Surgery (17.6%). (See Figure 17. 2 (9, $n = 1508$) = 23.09, $p < .01$).

Figure 17: Percentage expressing rather negative or very negative attitude towards work hours, by specialty.



Orthopaedics and Anaesthetists were most likely to lack influence over work hours, with 52.9% and 46.9% respectively report having no influence (see Figure 18. $\chi^2 (9, n= 1515) = 49.60, p < .001$). They were also most likely to lack opportunity for flexitime, with 38.2% and 41.7%, respectively reported having no flexitime (see Figure 19. $\chi^2 (9, n= 1513) = 31.14, p < .001$). Influence and flexitime were also low for Surgeons (43.1% reported no influence and 33% reported no flexitime) and Cardiologists (40.7% reported no influence and 33% reported no flexitime) and Cardiologists (40.7% and 32.1%).

Figure 18: Percentage having no influence over work hours, by specialty.

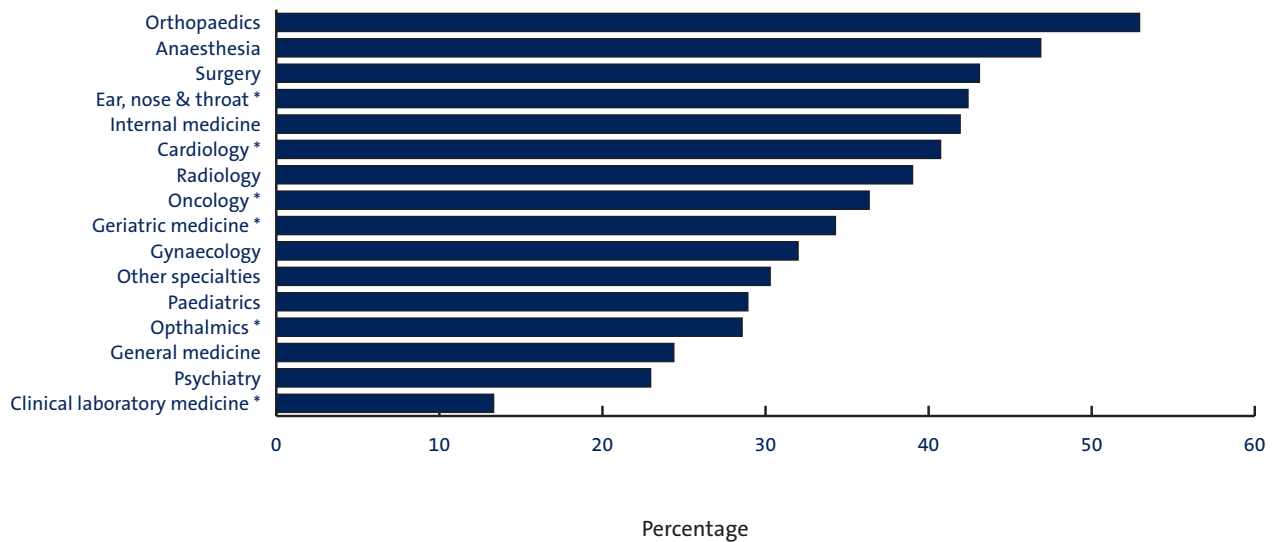
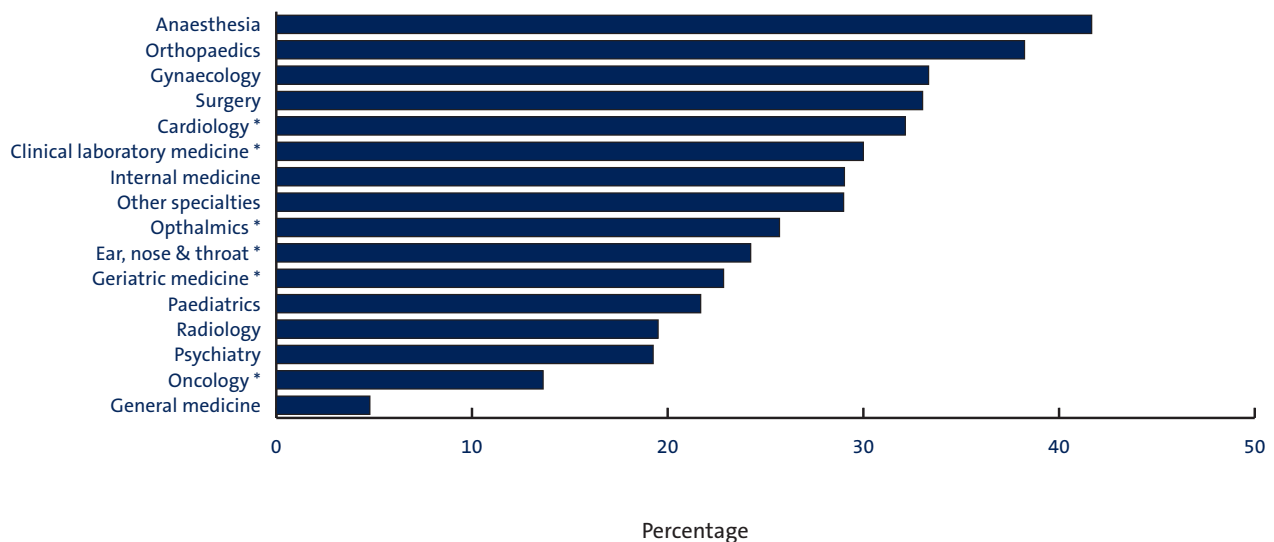
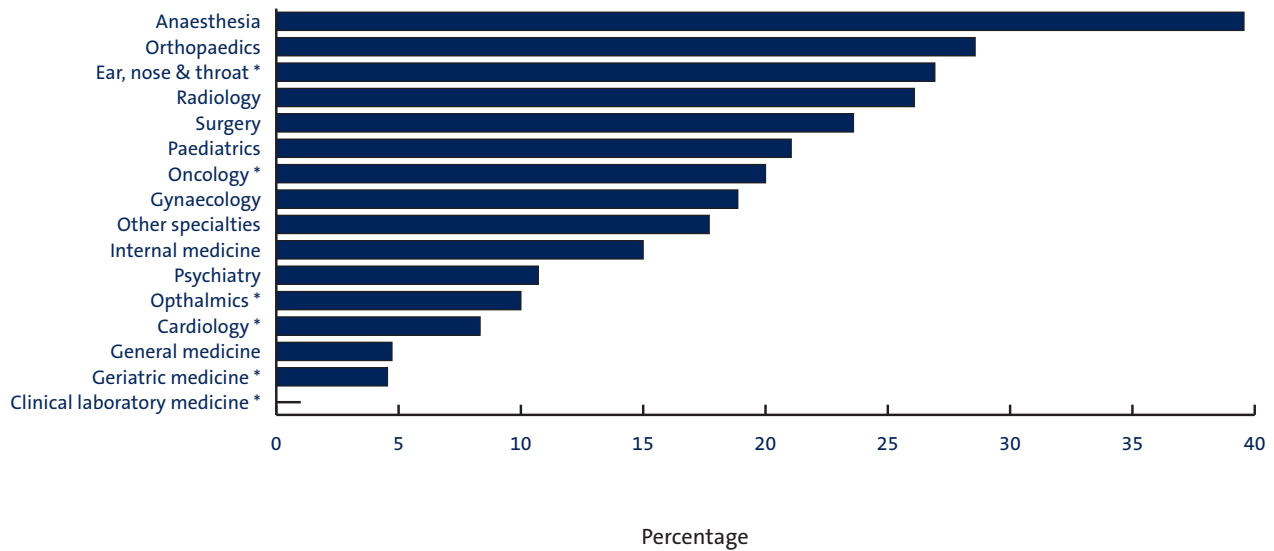


Figure 19: Percentage having no flexibility in work hours, by specialty.



Among those working non-standard hours, Anaesthetists and Orthopaedics were most likely to work shifts longer than 12 hours, with 39.6% and 28.6% respectively working 5 or more extended shifts per month (see Figure 20. $\chi^2 (18, n= 979) = 85.67, p < .001$). Frequent extended shifts were also observed among ENT specialists (26.9%) and Radiologists (26.1%).

Figure 20: Percentage working five or more shifts >12 hours per month



Among those working non-standard hours, quick returns were most common among Oncologists (85% report at least one < 11 QR per month and 63% reported at least one < 8 hr. QR per month), Surgeons (79.3% and 51.7%), ENT specialists (66.7% and 48.1%), Radiologists (66.2% and 44.1%), Orthopaedics (64.8% and 37.5%) and Cardiologists (62.5% and 41.7%) and Ophthalmologists (65% and 60%). (See Figures 21 and 22, respectively. *Quick returns < 11 hours*: $\chi^2 (18, n= 971) = 32.15, p < .05$. *Quick returns < 8 hours*: $\chi^2 (18, n= 965) = 43.07, p < .01$. Note that the latter analysis is potentially unreliable as it based on >20% of cells with an expected count of less than 5).

Figure 21: Percentage working at least one quick return (<11h) per month.

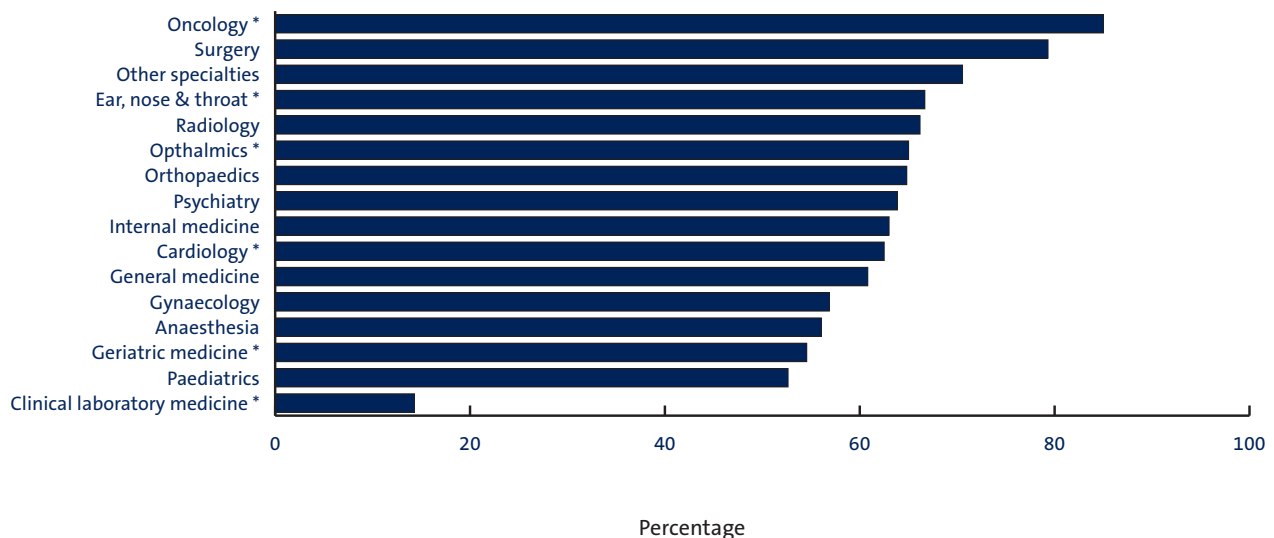
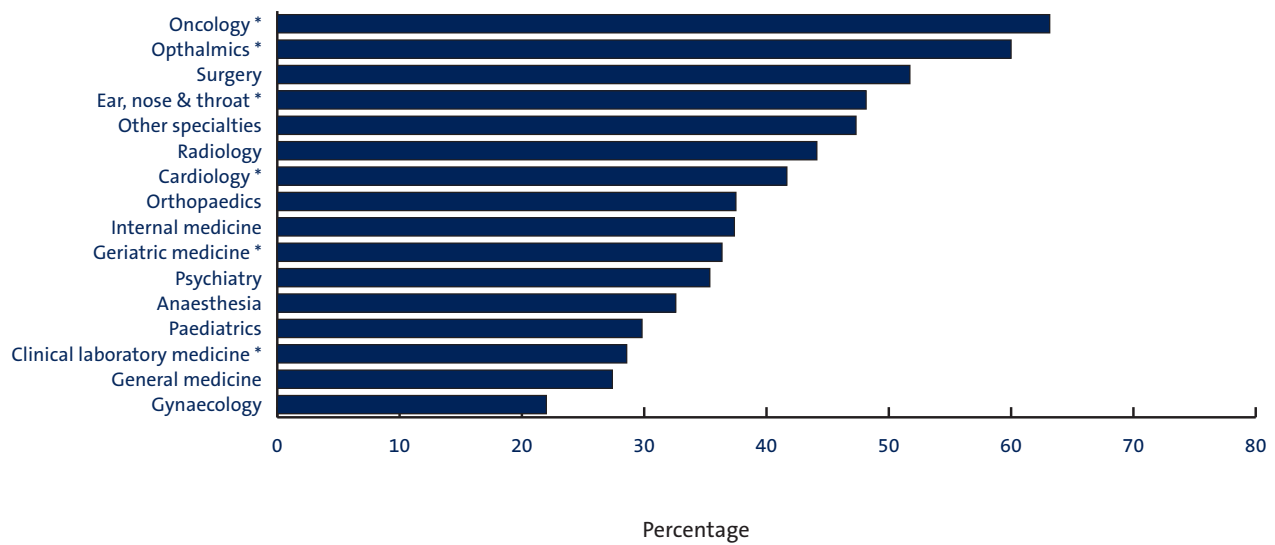


Figure 22: Percentage working at least one quick return (<8h) per month



The longest non-resident on-call hours were worked by Anaesthetists (55.2 hours per month), Surgeons (51.6), Ophthalmologists (50.2), Radiologists (49.8) and ENT specialists (48.0). (See Figure 23. $F(9,846) = 16.53, p < .001$). ENT specialists were most likely to work on-call as non-resident on-call (48% on-call at least 5 days per month). (See Figure 24. $\chi^2(18, n = 963) = 150.82, p < .001$)

Figure 23: Non-resident on-call hours worked per month (mean & standard error)

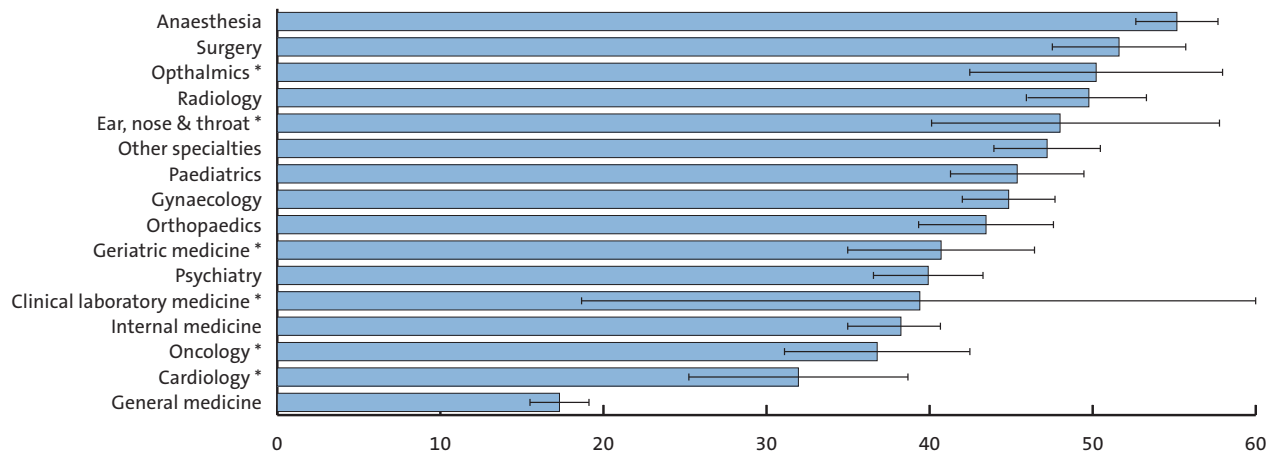
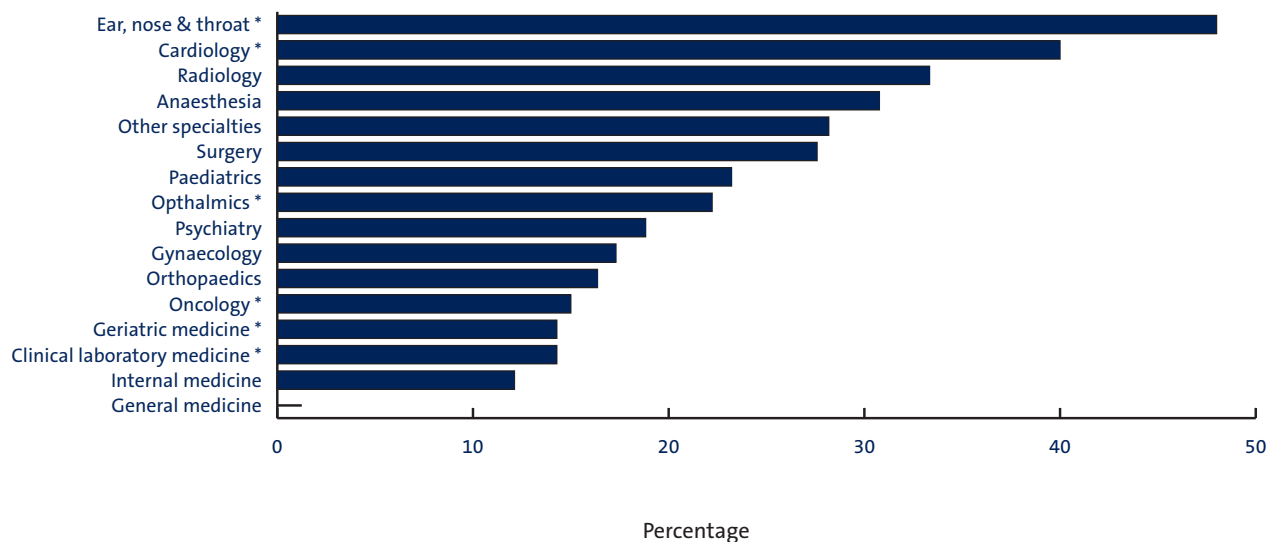


Figure 24: Percentage working non-resident on-call at least 5 days per month



Weekend working was most common among Surgeons (23.9% worked three or more weekends per month (resident on-call) and 43.7% had two or less free weekends per month), Anaesthetists (21.9% and 43.2%), Cardiologists (20.8% and 40%), Paediatricians (17.5% and 43.1%), Orthopaedics (14.3% and 36.4%), Radiology (12.1% and 27.9%) and Internal medicine (12% and 40.4%). (See Figures 25 and 26, respectively. *Number of weekend duties per month*: χ^2 (18, $n=972$) = 52.07, $p < .001$. *Number of completely free weekends per month*: χ^2 (18, $n=977$) = 112.53, $p < .001$).

Figure 25: Percentage working at least 3 or more weekends (resident on-call) per month

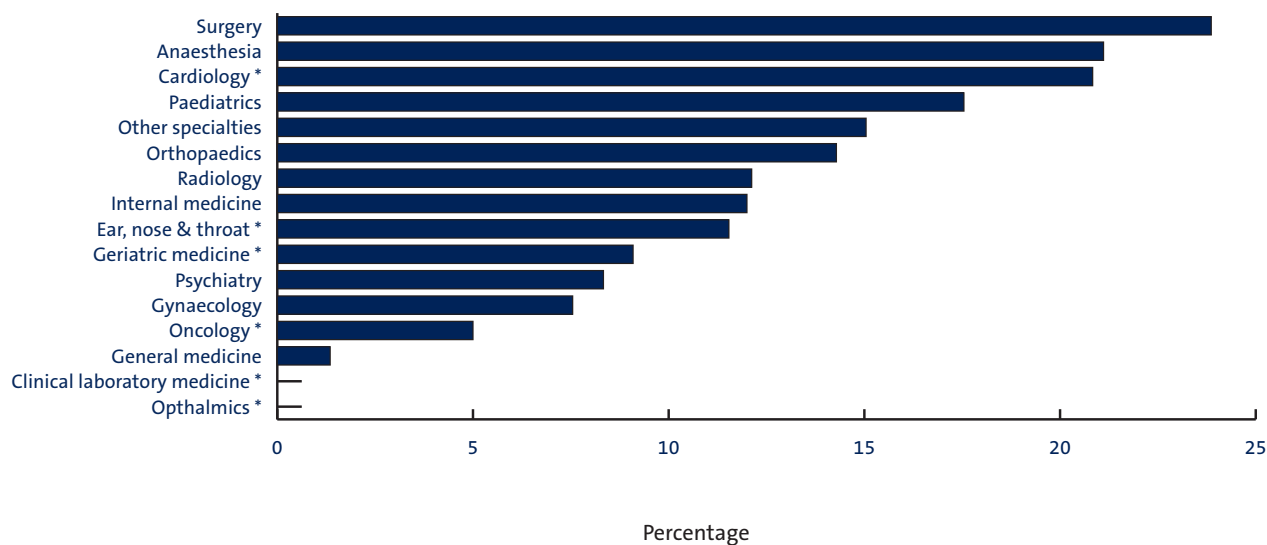
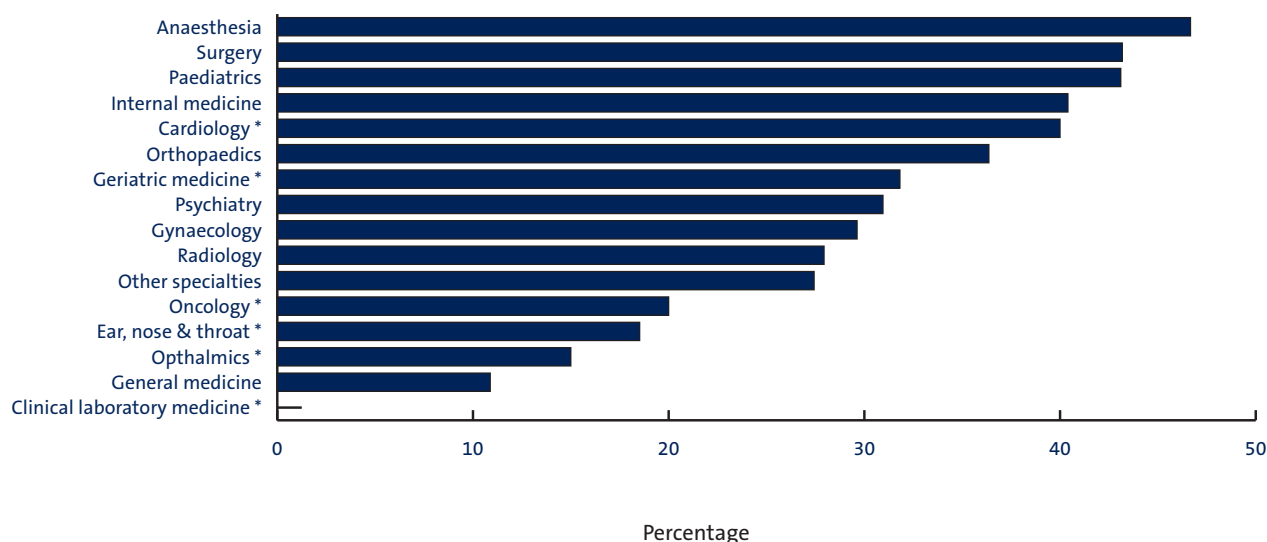
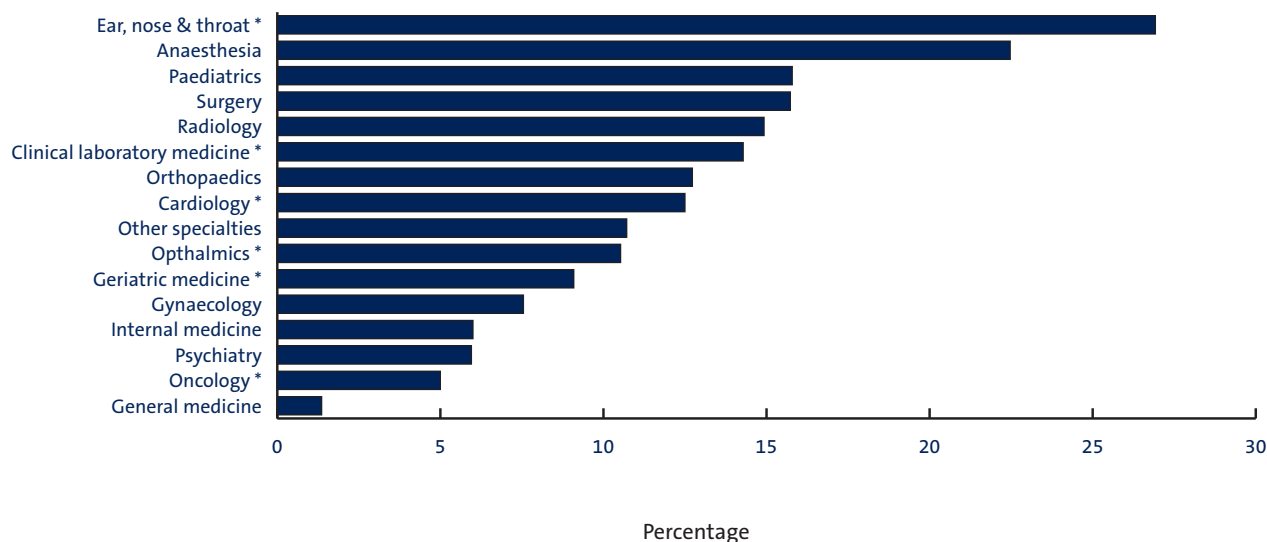


Figure 26: Percentage having <3 completely free weekends per month



Night work (resident on-call) was most common among ENT specialists (26.9% reported working 5 or more nights per month) and Anaesthetists (22.5%). (See Figure 27. $\chi^2 (18, n= 971) = 92.04, p < .001$).

Figure 27: Percentage working 5 or more night duties (resident on-call) per month



The respondents most likely to work a whole day either before or after a night shift were those in Clinical laboratory medicine (100% and 100%), Oncologists (92.9% and 92.9%), Ophthalmologists (100% and 85.7%) and those working in General medicine (82.6% and 54.8%). (See Figures 28 and 29, respectively. Working a whole day before a night: $\chi^2 (9, n= 764) = 122.33, p < .001$. Working a whole day after a night: $\chi^2 (9, n= 767) = 85.92, p < .001$).

Figure 28: Percentage working the whole day immediately before a night shift.

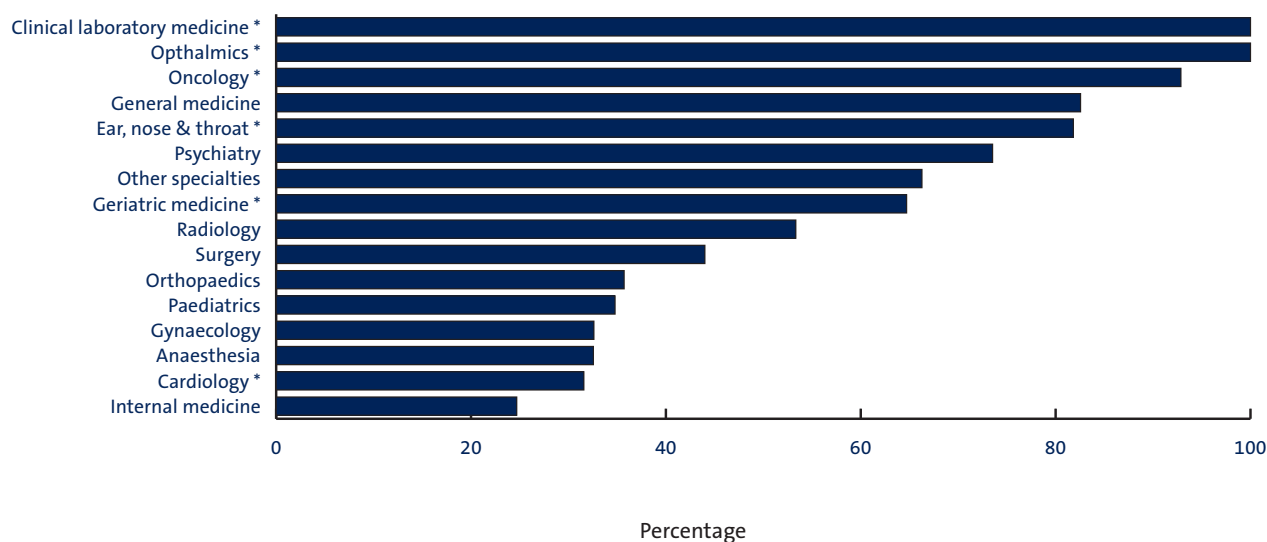
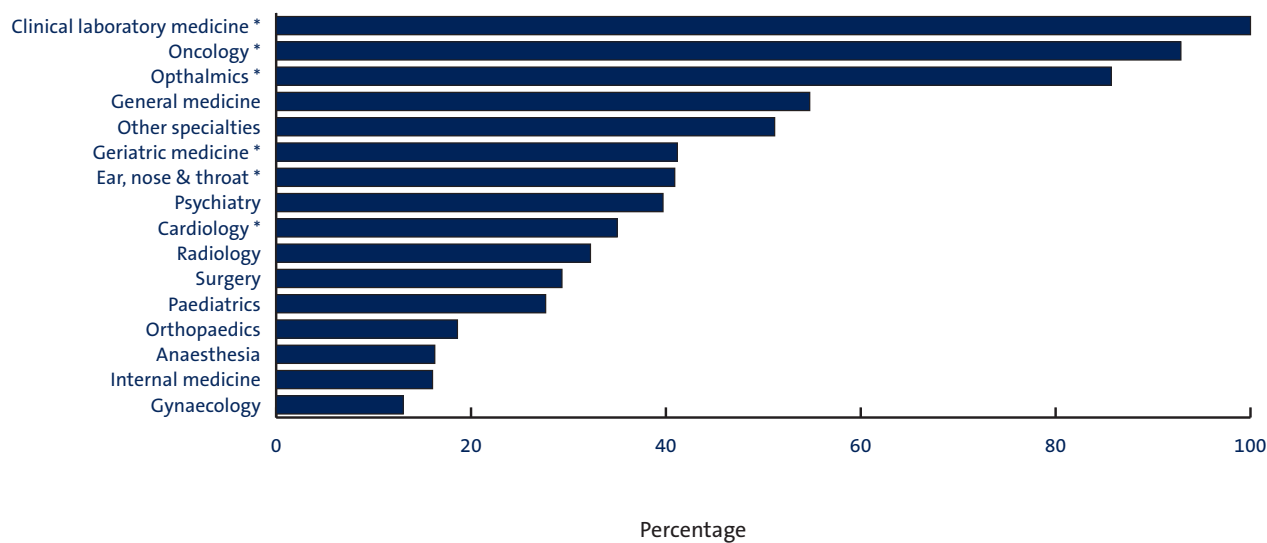
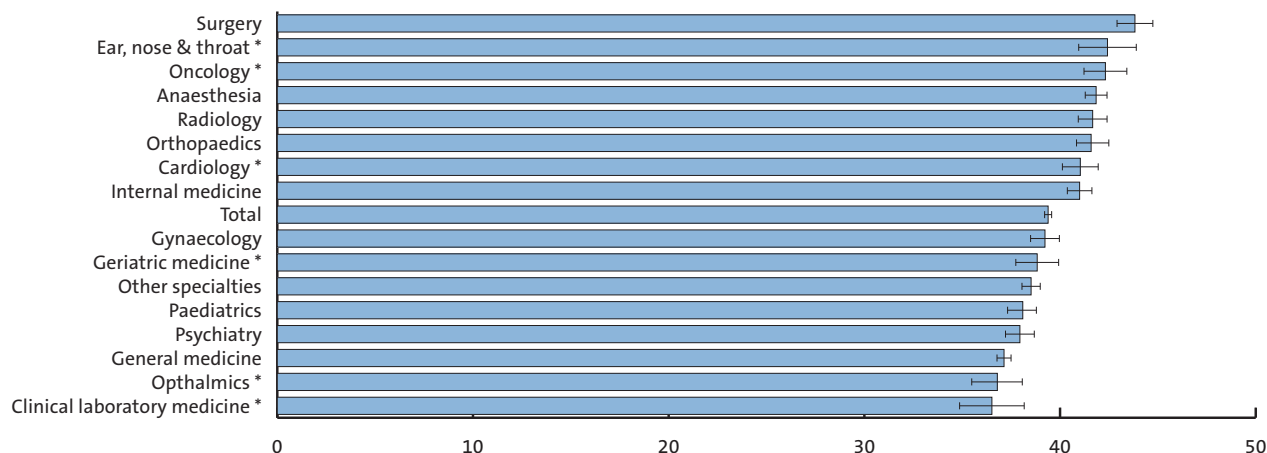


Figure 29: Percentage working the whole day immediately after a night shift



The longest contracted weekly hours were worked by Surgeons (43.8 hours per week), ENT specialist (42.4) and Oncologists (42.3). (See Figure 30. $F(9,1520) = 13.22$, $p < .001$). There were no significant differences between specialties in the number of unpaid hours worked ($F(9,1214) = 0.69$, $p > .05$).

Figure 30: Contracted weekly work hours (mean & standard error)



Broken down by regions (aggregated)

The analysis by region compared Stockholm, Västra Götaland, Skåne, Uppsala, the fourth category 'Northern Sweden' (comprising Västerbotten, Norrbotten, Västernorrland and Jämtland) and the fifth category 'Svea/Götaland' which comprised those locations in Svealand and Götaland not already classified in the other categories, i.e. Kalmar, Jönköping, Östra Götaland, Gävleborg, Värmland, Örebro, Halland, Kronoberg, Dalarna, Blekinge, Sörmland, Västmanland and Gotland.

There were no significant differences between the regions in terms of attitudes towards work hours ($\chi^2 (5, n = 1501) = 4.69, p > .05$). Västra Götaland had the highest proportion of respondents reporting no influence over their work hours (42.4%), while Svea/Götaland had the lowest proportion (25.8%). (See Figure 31. $\chi^2 (5, n = 1508) = 24.38, p < .001$). Similarly, Västra Götaland and Svea/Götaland had, respectively, the highest (36.8%) and lowest (15.8%) proportions of respondents with no access to flexitime (see Figure 32. $\chi^2 (5, n = 1506) = 58.62, p < .001$).

Figure 31: Percentage having no influence over work hours, by region.

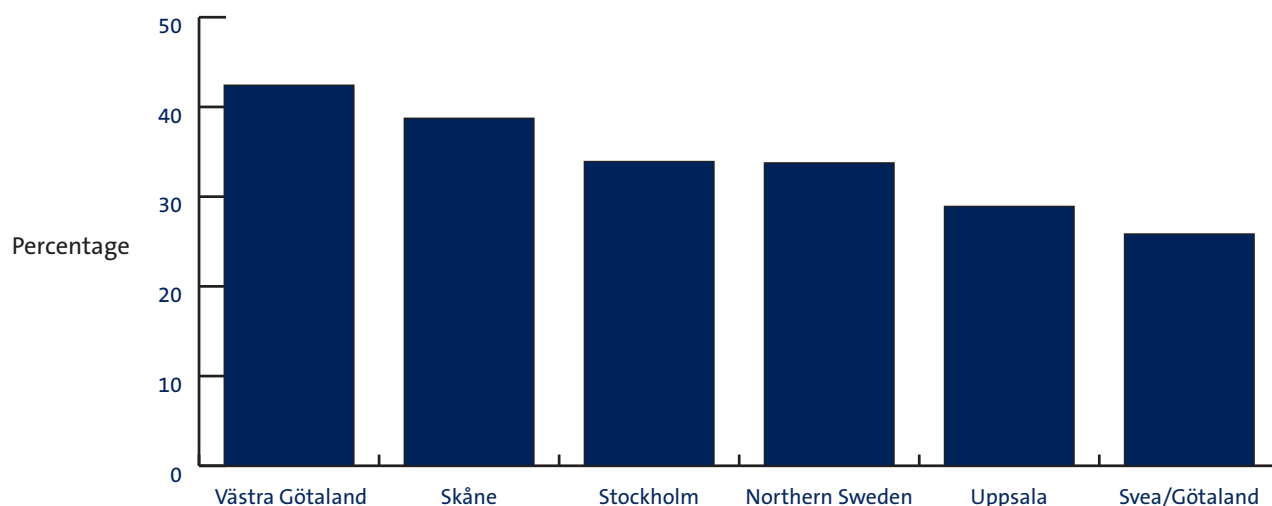
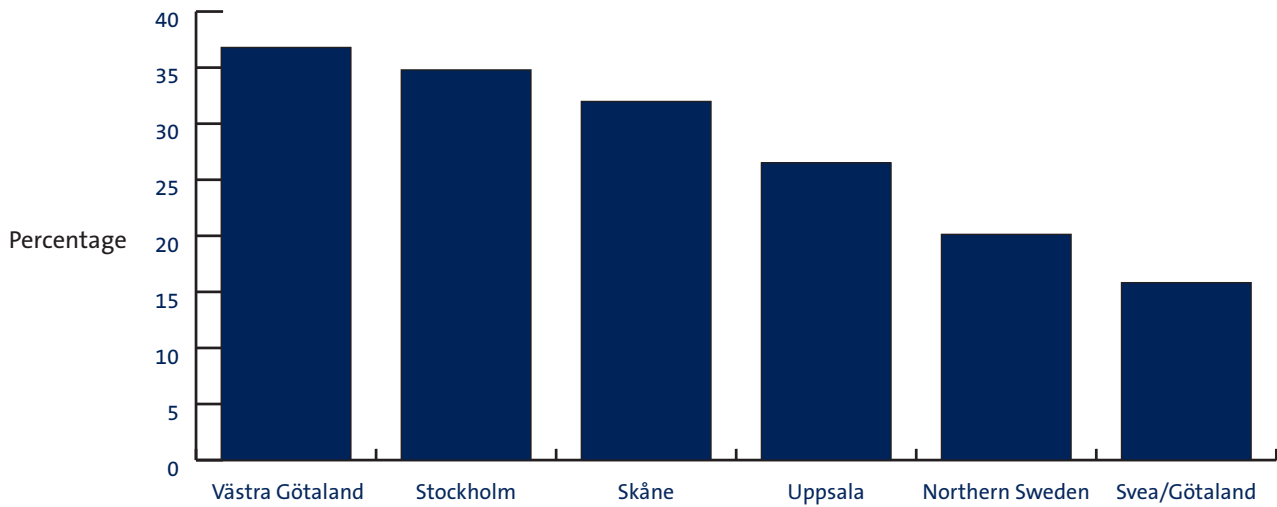


Figure 32: Percentage having no flexibility in work hours, by region.



Among respondents working non-standard hours, there were no significant differences between the regions in terms of frequency of shifts longer than 12 hours ($\chi^2 (10, n= 977) = 16.97, p > .05$) or frequency of quick returns (*quick returns* < 11 hours: $\chi^2 (10, n= 969) = 15.26, p > .05$; *quick returns* < 8 hours: $\chi^2 (10, n= 963) = 16.20, p > .05$).

Respondents in Stockholm worked fewest hours non-resident on-call (37.7 hours per month) and least frequent resident on-call duties (10.3% work at least 5 days on-call per month), while those in Uppsala worked the most on-call (53.3 hours, 29.4%). (See Figures 33 and 34. *Hours non-resident on-call*: $F(5,845) = 2.39, p < .05$. *Frequency of non-resident on-call*: $\chi^2 (10, n= 962) = 31.75, p < .001$).

Figure 33: Resident on-call hours worked per month (mean & standard error)

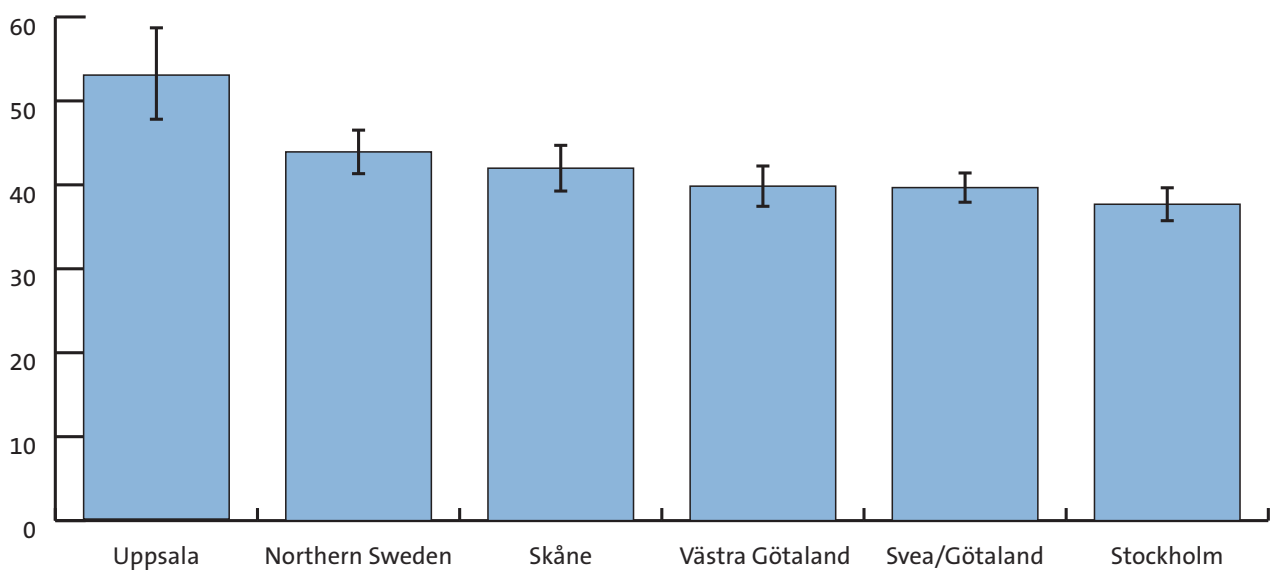
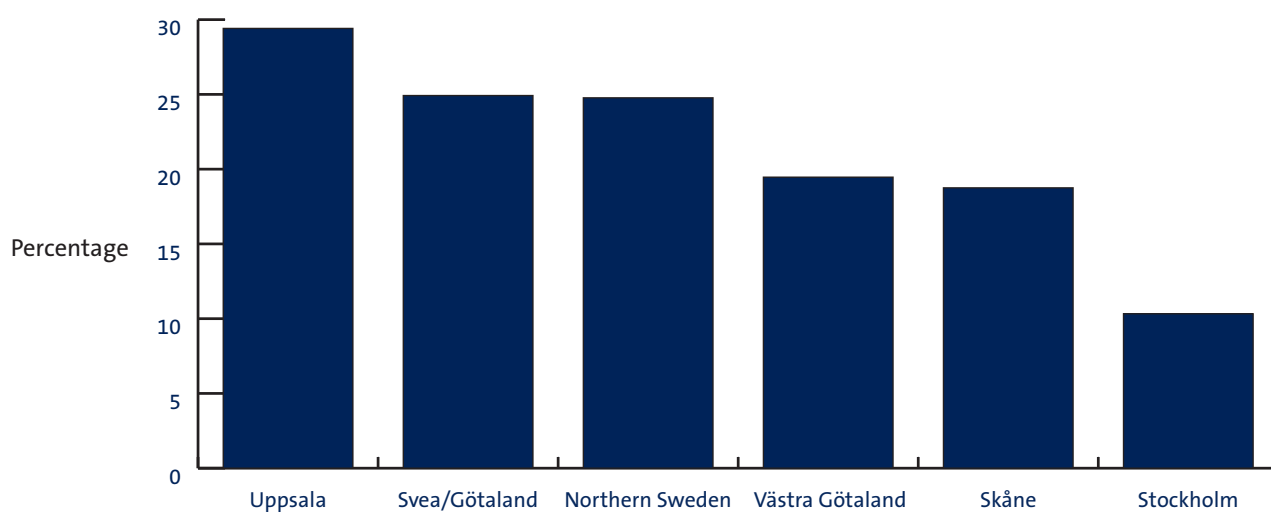


Figure 34: Percentage working non-resident on-call at least 5 days per month



There were no significant differences between the regions in terms of weekend working (*Frequency of weekends worked resident on-call*: $\chi^2 (10, n= 971) = 4.02, p > .05$. *Number of completely free weekends*: $\chi^2 (10, n= 975) = 11.89, p > .05$).

There were no significant differences between regions in the frequency of night shifts ($\chi^2 (10, n= 970) = 10.15, p > .05$). Respondents in the North of Sweden most likely to work whole days before night shifts (69.3%) and after night shifts (56.6%), while those in Stockholm were least likely to (35.3% and 20.5%). (See Figures 35 and 36. *Working whole day before a night shift*: $\chi^2 (5, n= 762) = 45.72, p < .001$. *Working whole day after night shift*: $\chi^2 (5, n= 765) = 29.78, p < .001$).

Figure 35: Percentage working the whole day immediately before a night shift

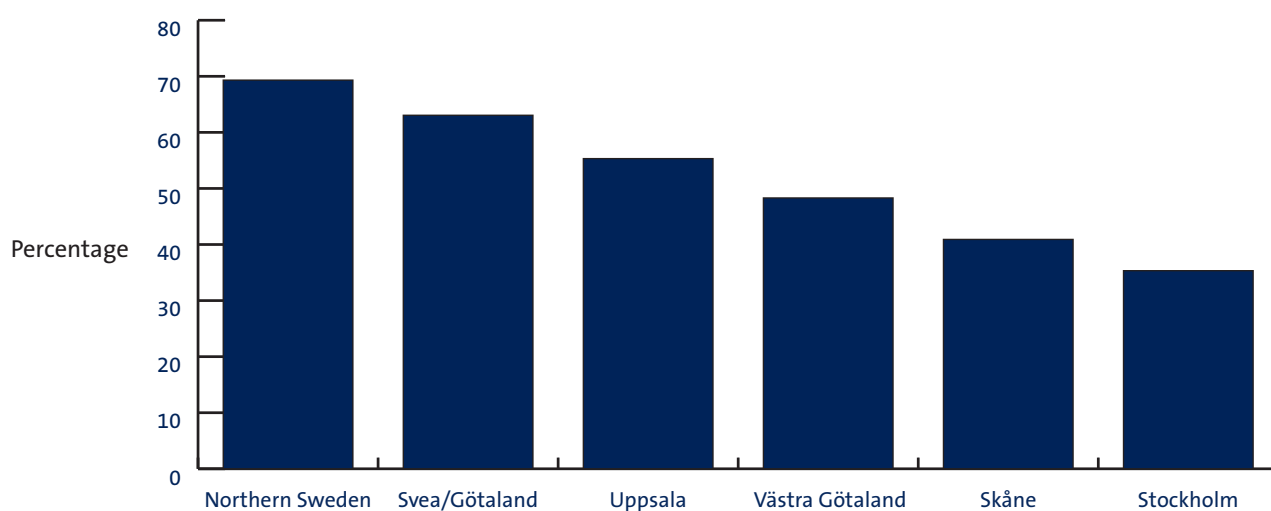
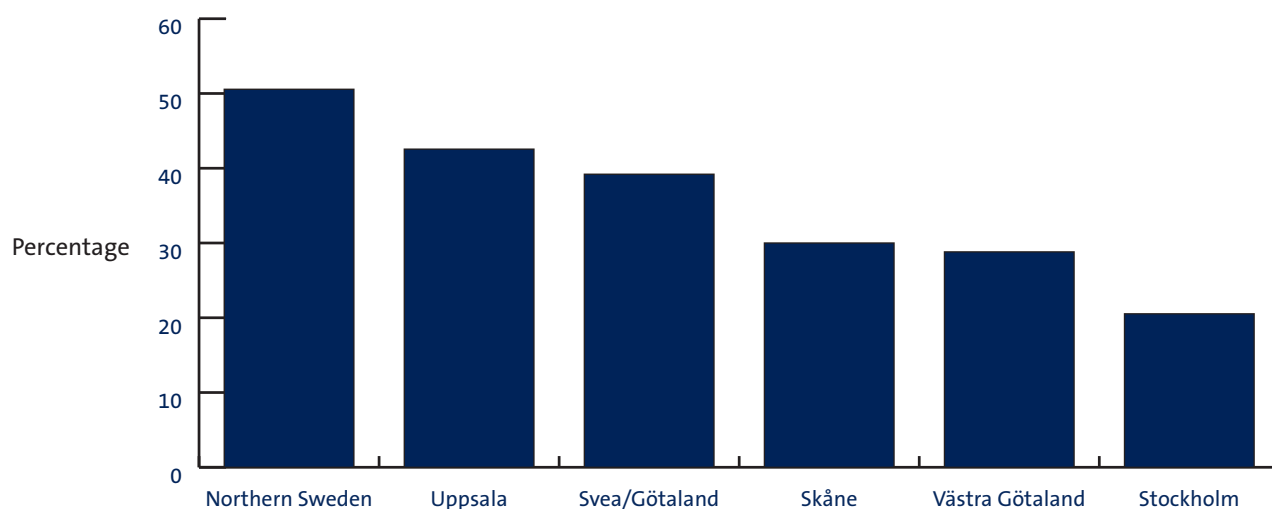
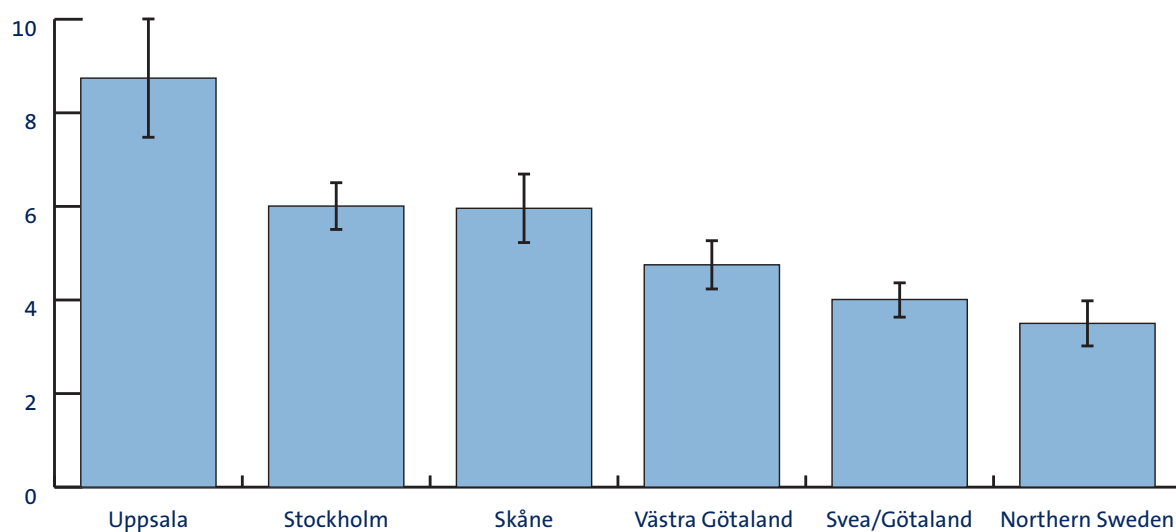


Figure 36: Percentage working the whole day immediately after a night shift



While there was no statistical difference between the regions in weekly work hours ($F(5,1509) = 0.70, p > .05$), respondents in Uppsala worked the most unpaid hours per week (8.7 hours). (See Figure 37. $F(5,1209) = 6.34, p < .001$).

Figure 37: Unpaid weekly work hours (mean & standard error)



Broken down by type of employers

The analysis by type of employer compared those employed in the public sector (District, City or Region) with those employed in the private sector (Corporatized or Private organisations).

There were no significant differences between the two groups in terms of attitudes towards work hours ($\chi^2 (1, n = 1408) = 0.59, p > .05$) or with respect to influence over work hours ($1, n = 1415) = 3.61, p > .05$). However, private sector employees were more likely to report no access to flexitime (Public = 25.3%; Private = 36.1%; $\chi^2 (1, n = 1414) = 10.29, p < .01$).

Among those working non-standard hours, there were no significant differences with respect to shifts longer than 12 hours ($\chi^2 (2, n= 946) = 4.48, p > .05$) or quick returns (*quick returns < 11 hours*: $\chi^2 (2, n= 939) = 1.92, p > .05$; *quick returns < 8 hours*: $\chi^2 (2, n= 933) = 4.01, p > .05$).

Among those working non-standard hours, while there was no significant difference in terms of the number of hours worked resident on-call ($F(1,821) = 2.84, p > .05$), public sector workers were more likely to work non-resident on-call, with 21.3% working at least 5 days per month, as compared to 7.9% in the Private sector ($\chi^2 (2, n= 939) = 9.92, p < .01$).

Among those working non-standard hours, there were no differences between the groups with respect to frequency of weekends worked resident on-call ($\chi^2 (2, n= 940) = 0.17, p > .05$) or the number of completely free weekends ($\chi^2 (2, n= 946) = 3.11, p > .05$). Nor did the groups differ with respect to night work (*frequency of night shifts, resident on-call*: $\chi^2 (2, n= 939) = 1.86, p > .05$. *likelihood of being free during the days immediately before and after a night shift*: $\chi^2 (1, n= 739) = 1.54, p > .05$ and $\chi^2 (1, n= 742) = 2.42, p > .05$).

The two groups did not differ in terms of weekly work hours ($F(1,1419) = 2.95, p > .05$) or in terms of the number of unpaid hours worked per week ($F(1,1140) = 0.52, p > .05$).

Regression analyses

For the purposes of the analyses that follow, some of the scales were reverse coded so that all scales range from low scores indicating positive outcomes, to high scores indicating negative outcomes. The scales in question were burnout, fatigue after work, work ability, how often workload risks malpractice and continuity of care. In addition, responses to the item on continuity of care were aggregated into three categories (1 – ‘Just enough or too much’, 2 – ‘Too little’, 3 – ‘Far too little’).

Preliminary analyses

Preliminary analyses indicated that two of the variables (Number hours worked resident on-call per month; Weekly unpaid work hours) were highly negatively skewed. These variables were subjected to log transformation for the purposes of the analyses that follow. It was also noted that there were high bivariate correlations between the variables Frequency of quick returns < 11 hours and Frequency of quick returns < 8 hours ($r = .72, p < .001$) as well as moderately high correlations between each of these variables and Frequency of shifts > 12 hours ($r = .64$ and $r = .48$, respectively). In order to reduce problems of multicollinearity, the variable Frequency of quick returns < 8 hours was excluded from the set of predictors examined in the analyses that follow. (Note that the variable Frequency of quick returns < 11 hours refers to quick returns of any duration under 11 hours, including those of less than 8 hours).

Reliability analysis was conducted on each of the multi-item scales, namely disturbed sleep (*Cronbach's alpha* = .87), burnout (*Cronbach's alpha* = .87), stress (*Cronbach's alpha* = .73) and fatigue after work (*Cronbach's alpha* = .78).

General analytic strategy

Four types of outcome variables were examined, namely Sleep, Wellbeing, Attitudes and Patient Care. Following preliminary descriptive analyses of the outcome variables (see Table 1, below),

each outcome variable was subjected to four pairs of regression analyses, based on four different groupings of the participants. Each pair of analyses comprised an unadjusted regression and a regression adjusted for age, sex, job grade and specialty. Linear regression was used in all cases, except in the analyses of the outcome variable 'Have you been reported in the last 5 years?', which was analysed using ordinal regression.

The reason for conducting four pairs of analysis on different groups of participants was to try to maximise the number of participants contributing to the examination of each predictor. Response rates for the some of the predictor variables were relatively low (i.e. Number hours worked resident on-call per month, Frequency of completely free weekends, Proportion of night duty spent actively working, Proportion of the day after a night shift that is free, Proportion of the day before a night shift that is free, Frequency of being non-resident on-call and Frequency of being contacted during a non-resident on-call duty). The low response rates for these variables was most likely because respondents tended to only answer questions that related to the type of schedule they worked (e.g. many respondents who did not work resident on-call did not answer the item Number of hours worked resident on-call per month). A single analysis that included all the predictors would have been based on only those relatively few participants who answered every question about work schedules.

For each outcome variable, the first pair of analyses was based on the entire sample (excluding those describing their position as Director, Professor / lecturer or Other; N excluded = 248). The outcome was regressed onto nine working time parameters, namely Influence over working time, Access to flexitime, Frequency of shifts > 12 hours, Frequency of quick returns < 11 hours, Frequency of weekend resident on-call, Frequency of night duties resident on-call, Weekly work hours, and Weekly unpaid work hours.

The second pair of analyses was based on only those participants who reported working weekend resident on-call. The outcome was regressed onto 11 working time parameters, namely Influence over working time, Access to flexitime, Frequency of shifts > 12 hours, Frequency of quick returns < 11 hours, Frequency of weekend resident on-call, Frequency of night duties resident on-call, Number hours worked resident on-call per month, Frequency of completely free weekends, Weekly work hours, and Weekly unpaid work hours.

The third pair of analyses was based only on those participants who reported working night duties resident on-call. The outcome was regressed onto 13 working time parameters, namely Influence over working time, Access to flexitime, Frequency of shifts > 12 hours, Frequency of quick returns < 11 hours, Frequency of weekend resident on-call, Frequency of night duties resident on-call, Number hours worked resident on-call per month, Proportion of night duty spent actively working, Proportion of the day after a night shift that is free, Proportion of the day before a night shift that is free, Weekly work hours, and Weekly unpaid work hours.

The fourth pair of analyses was based only on those participants who reported working non-resident on-call. The outcome was regressed onto nine working time parameters, namely Influence over working time, Access to flexitime, Frequency of shifts > 12 hours, Frequency of quick returns < 11 hours, Frequency of being non-resident on-call, Frequency of being contacted during a non-resident on-call duty, Weekly work hours, and Weekly unpaid work hours.

In addition to the above analyses, two additional analyses of the entire sample were conducted on each outcome variable to examine two other potential predictors of the outcome variables, namely Attitude to work hours and Stress. In each case, the adjusted analyses based on the entire sample was repeated, but with the inclusion of the additional predictor as a third step. The first of these analyses sought to investigate whether having work hours that suit one's personal preference is more influential than any particular working time arrangement parameter. The second sought to examine whether any of the observed associations between working time parameters and the outcomes could be accounted for in some way by stress. For example, if a significant association between working time parameter and outcome became non-significant after including stress as an additional predictor, this would suggest that the initially significant association was due at least in part to the influence of stress e.g. as a mediator or as an underlying determining influence on both the working time parameter and the outcome in question.

Note that for the sake of parsimony, when discussing the results of the second, third and fourth pairs of analysis, the discussion will only focus on those associations that pertain to the particular type of schedules being examined. Thus, when discussing the second pair of analysis, discussion will focus only on those predictors directly relating to weekend working; when discussing the third pair of analyses, discussion will focus only on predictors directly relating to night working; when discussing the fourth pair of analyses, discussion will focus only on predictors directly relating to non-resident on-call working.

Descriptive analysis

Table 1 provides descriptive statistics for the outcome variables associated with each of the four pairs of analyses. The table also includes some comparison data obtained from a large representative sample of the working population in Sweden who participated in the Swedish Longitudinal Occupational Survey of Health (SLOSH; www.slosh.se) in 2010. Two sets of comparison data are provided: firstly, for the whole SLOSH sample (participants in gainful employment); and secondly, for those participants whose work includes night work. Single-sample t-tests were conducted to compare (i) scores from the current whole sample (excluding those describing their position as Director, Professor / lecturer or Other) with scores from the SLOSH participants (all workers); and (ii) scores from night workers in the current sample with night workers in the SLOSH sample.

As can be seen in Table 1, all comparisons indicated highly significant differences. Doctors as a whole reported less disturbed sleep than the general working population (as represented by SLOSH participants) and the same was true in the comparison of night workers. Doctors as a whole reported greater frequency of short sleeps (< 6 hours) compared to the general working population. However, short sleeps were more common among the general population of night workers than in the current sample of night working doctors. Doctors as a whole were more likely to report getting insufficient sleep than the general working population and the same was true in the comparison of night workers. Doctors as a whole reported higher levels of burnout and stress compared to the working population and the same was true in the comparison of night workers.

Table 1. Means (and standard deviations) of the outcome variables associated each pair of analyses, plus comparison data from SLOSH

	N	Disturbed sleep	Exhausted on awakening	<6 hrs sleep	Thoughts about work	Get enough sleep?	How would you rate your sleep?	Burnout ¹	Stress	Fatigue ¹ after work ¹	General health	Work ability ¹	Combining work & family	Feelings about work	Attitude to work hours	Thoughts of changing	Risk of mis-take stress	Workload risks mal-practice ¹	Reported in last 5 years (at least once)	Continuity of care
Possible scores		1-6	1-6	1-6	1-6	1-5	1-5	1-7	1-4	1-5	1-5	1-10	1-4	1-5	1-5	0-5	1-5	1-4		1 - 3
Whole sample	1287	2.55 (1.09)	2.71 (1.33)	2.95 (1.26)	2.28 (1.07)	2.66 (0.93)	2.38 (1.04)	3.79 (1.37)	1.95 (0.63)	3.32 (0.90)	1.99 (0.79)	2.81 (1.43)	2.15 (0.65)	2.22 (0.92)	2.32 (0.94)	1.87 (1.51)	3.04 (0.96)	2.36 (0.98)	32.2 %	1.46 (0.70)
Weekend working	805	2.51 (1.06)	2.78 (1.29)	3.01 (1.22)	2.30 (1.02)	2.71 (0.90)	2.36 (1.01)	3.81 (1.32)	1.96 (0.60)	3.33 (0.87)	1.93 (0.74)	2.66 (1.31)	2.20 (0.63)	2.22 (0.91)	2.47 (0.93)	1.96 (1.51)	3.13 (0.94)	2.48 (0.94)	35.1 %	1.52 (0.71)
Night working	619	2.50 (1.04)	2.82 (1.29)	3.07 (1.23)	2.26 (1.00)	2.73 (0.92)	2.37 (1.00)	3.80 (1.32)	1.95 (0.60)	3.35 (0.86)	1.92 (0.75)	2.64 (1.34)	2.22 (0.63)	2.23 (0.90)	2.52 (0.94)	1.97 (1.51)	3.15 (0.95)	2.49 (0.94)	35.6 %	1.56 (0.72)
Non-resident on-call	517	2.58 (1.07)	2.66 (1.28)	3.06 (1.22)	2.34 (1.06)	2.67 (0.91)	2.40 (1.03)	3.74 (1.33)	1.96 (0.61)	3.30 (0.86)	1.95 (0.74)	2.64 (1.22)	2.15 (0.64)	2.19 (0.91)	2.43 (0.93)	1.84 (1.46)	2.98 (0.93)	2.44 (0.97)	37.2 %	1.42 (0.68)
SLOSH: all workers	9132	2.63 (1.07) ***	2.78 (1.32) ***	2.78 (1.32) ***	2.46 (0.92) ***	2.46 (0.92) ***	2.46 (0.92) ***	3.22 (1.15) ***	1.68 (0.58) ***											
SLOSH: night workers	556	2.71 (1.10) ***		3.26 (1.36) ***		2.53 (0.97) ***		3.07 (1.05) ***	1.53 (0.53) ***											

¹ Reverse coded

*** = $p < .001$

Working time arrangements as predictors of sleep outcomes

In the analyses of the entire sample, having influence over work hours was a strong predictor of positive outcomes in five of the six analyses relating to sleep, with the exception of short (<6 hours) sleep. Lacking access to flexitime was also a significant predictor of short (<6 hours) sleeps and not getting enough sleep. Working long shifts (>12 hours) was a significant predictor of not getting enough sleep and lower overall sleep ratings. Number of unpaid work hours was also a predictor of five of the six sleep-related outcomes, with the exception of getting enough sleep (see Table 2).

In the analyses of weekend working, a higher number of completely free weekends predicted less disturbed sleep and better overall ratings of sleep. Higher frequency of weekend working was associated with *lower* likelihood of feeling exhausted on awakening (see Table 3).

In the analysis of night working, a higher proportion of night duty spent actively working was associated with feeling exhausted on awakening. Working the day before a night shift was also associated with feeling exhausted on awakening (see Table 4).

In the analyses of non-resident on-call working, a *higher* frequency of on-call duties was associated with a *better* overall rating of sleep (see Table 5).

Table 2: Standardized beta weights (and R² values) for the analyses of sleep outcomes in the entire sample (excluding directors, professors, etc.)

	Disturbed sleep		Exhausted on awakening		<6 hrs. sleep		Thoughts about work		Get enough sleep?		How would you rate your sleep?	
	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.127 **	.139 ***	.164 ***	.144 ***	.043	.045	.134 **	.140 **	.147 ***	.132 **	.125 **	.130 **
Do you have some form of flexitime, ... ?	.043	.041	.064	.076 §	.094 *	.095 *	.025	.028	.074	.079 *	.015	.007
How often are your shifts longer than 12 hours ...?	.080	.093	.040	.047	.092	.100	-.007	.025	.167 **	.168 **	.118 *	.117 *
How often is the time off ... between your shifts ... less than 11 hours?	.037	.011	.009	.038	.138 **	.125 **	.059	.034	.023	.033	-.006	-.019
How often do you work weekends on-call (days)?	-.044	-.037	-.043	-.061	-.052	-.057	-.041	-.036	-.050	-.060	-.036	-.042
How often do you work night duty (on-call)?	-.068	-.008	.008	-.009	-.003	.010	-.051	-.011	-.029	-.022	-.078	-.036
Number of hours worked per week in your employment	-.059	-.001	-.001	.034	.034	.043	-.059	-.018	-.016	.019	-.048	-.014
Number of work hours per week without compensation	.139 ***	.119 **	.075 *	.110 **	.121 **	.112 **	.174 ***	.158 ***	.052	.061	.105 **	.092 *
R ²	.059	.141	.054	.111	.089	.116	.064	.112	.074	.123	.043	.101
Attitude to work hours		.177 ***		.249 ***		.114 **		.176 ***		.337 ***		.227 ***
R ²		.163		.160		.125		.133		.210		.137
Stress		.505 ***		.474 ***		.283 ***		.547 ***		.397 ***		.436 ***
R ²		.372		.314		.188		.380		.262		.270

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

The upper panel of the table (above the first thick line) shows the results of the analysis before adding either 'Attitude to work hours' or 'Stress' as predictors. The last two rows show the strength of association between (1) the attitude variable and the outcome variables, after controlling for the working time parameters, age, sex, job grade and specialty and (2) the stress variable and the outcome variables, after controlling for the working time parameters, age, sex, job grade and specialty.

Table 3: Standardized beta weights (and R² values) for the analyses of sleep outcomes in respondents who worked weekends.

	Disturbed sleep		Exhausted on awakening		<6 hrs. sleep		Thoughts about work		Get enough sleep?		How would you rate your sleep?	
	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.139 **	.160 ***	.155 **	.145 **	.023	.029	.107 *	.126 **	.139 **	.132 **	.126 **	.137
Do you have some form of flexitime, ... ?	.009	.020	.046	.066	.065	.066	.006	.016	.063	.075	-.026	-.029
How often are your shifts longer than 12 hours ...?	.013	.029	.024	.018	.047	.042	-.036	.001	.150 *	.146 *	.061	.055
How often is the time off ... between your shifts ... less than 11 hours?	.054	.038	.093	.099	.132 **	.123 *	.088	.056	.021	.036	.022	.012
How often do you work weekends on-call (days)?	-.031	-.063	-.094 *	-.102 *	-.018	-.033	-.016	-.033	-.066	-.078	-.033	-.059
How often do you work night duty (on-call)?	-.017	.035	.064	.024	.046	.061	-.017	.019	-.030	-.021	-.075	-.034
How many hours per month are resident on-call?	-.051	-.046	-.141 *	-.091	-.031	-.054	-.069	-.061	-.040	-.053	-.015	-.023
How many weekends per month, you are completely free ...?	.126 **	.125 **	.075	.065	.051	.052	.083	.088 §	.070	.055	.134 **	.122 **
Number of hours worked per week in your employment	-.027	.028	.025	.063	.071	.085	-.055	-.017	.012	.054	-.032	.004
Number of work hours per week without compensation	.123 **	.101 *	.055	.078	.136 **	.118 **	.154 ***	.128 **	.059	.060	.100 *	.086 *
R ²	.065	.149	.063	.109	.087	.115	.059	.103	.071	.122	.054	.112

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

Table 4: Standardized beta weights (and R² values) for the analyses of sleep outcomes in respondents who worked nights

	Disturbed sleep		Exhausted on awakening		<6 hrs. sleep		Thoughts about work		Get enough sleep?		How would you rate your sleep?	
	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.123 *	.140 **	.109 *	.090	.066	.073	.077	.092	.107 *	.102 *	.112 *	.118 *
Do you have some form of flexitime, ... ?	-.011	-.010	.037	.054	.058	.053	-.044	-.030	.075	.085	-.054	-.065
How often are your shifts longer than 12 hours ...?	.118	.090	.023	.032	.067	.049	.094	.096	.182 **	.156	.166 *	.147 *
How often is the time off ... between your shifts ... less than 11 hours?	.061	.079	.111	.125 §	.158 *	.175 **	.032	.029	.082	.103	.090	.100
How often do you work weekends on-call (days)?	-.033	-.070	-.104 §	-.111	-.068	-.089	-.002	-.021	-.086	-.118 *	-.065	-.112 *
How often do you work night duty (on-call)?	.010	.050	.008	.024	-.001	.009	.014	.039	-.026	-.008	-.066	-.018
How many hours per month are resident on-call?	-.023	-.026	-.082	-.097	.025	-.002	-.038	-.022	-.050	-.073	-.018	-.043
How much of a night-call is active work?	-.023	-.073	-.213 *	-.249 **	-.064	-.106	-.047	-.055	-.021	-.085	-.063	-.144
Are you generally free directly after a night shift?	.036	.032	-.106	-.085	-.044	-.048	.141	.115	-.066	-.057	.000	-.010
Are you generally free directly before a night shift?	.000	-.047	.190 *	.176 *	.093	.098	-.030	-.057	-.037	-.034	-.019	-.035
Number of hours worked per week in your employment	-.025	.035	.020	.058	.069	.081	-.069	-.028	-.002	.029	-.049	-.008
Number of work hours per week without compensation	.136 **	.117 *	.090	.106 *	.140 **	.114 *	.188 ***	.169 **	.054	.043	.086	.057
R ²	.061	.154	.074	.122	.098	.127	.068	.110	.077	.132	.052	.139

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

Table 5: Standardized beta weights (and R² values) for the analyses of sleep outcomes in respondents who worked non-resident on-call

	Disturbed sleep		Exhausted on awakening		<6 hrs. sleep		Thoughts about work		Get enough sleep?		How would you rate your sleep?	
	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.167 **	.157 **	.169 **	.161 **	.005	.001	.109 §	.113 *	.151 **	.139 *	.173 **	.176 **
Do you have some form of flexitime, ... ?	-.038	-.010	-.024	-.010	.075	.078	.040	.053	.032	.036	-.081	-.092
How often are your shifts longer than 12 hours ...?	.035	.025	.008	-.002	.093	.077	-.011	.014	.160 *	.152 *	.112	.108
How often is the time off ... between your shifts ... less than 11 hours?	.012	.061	.038	.071	.094	.111	.008	.027	.009	.053	-.061	-.015
How often are you on-call (back up) on average?	-.069	-.072	-.107	-.099	-.015	-.031	-.011	-.019	-.071	-.075	-.137 *	-.153 *
How often you will be contacted during on-call ...?	-.008	.002	.042	.047	.073	.062	.051	.057	.017	.036	-.032	-.019
How many weekends per month, you are completely free ...?	.081	.055	.091	.067	.105 *	.089	.705	.029	.056	.030	.122 *	.094
Number of hours worked per week in your employment	-.064	-.019	-.007	.039	.056	.075	-.100	-.071	.016	.054	-.030	.011
Number of work hours per week without compensation	.167 ***	.149 **	.055	.083	.050	.049	.209 ***	.187 **	.009	.008	.070	.047
R ²	.076	.185	.059	.124	.093	.143	.082	.129	.076	.138	.069	.154

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

Working time arrangements as predictors of wellbeing outcomes

In the analyses of the entire sample, having influence over work hours was a strong positive predictor of five of the six outcomes relating to wellbeing, with exception of work ability. Longer unpaid weekly work hours were associated with greater burnout, higher stress, worse ratings of fatigue after work, and greater difficulty combining work and family. Higher weekly work hours were associated with *higher* work ability scores (see Table 6).

In the analyses of weekend working, higher frequency of weekend working was associated with greater difficulties combining work & family. A lack of completely free weekends was also associated with higher stress (see Table 7).

There were no significant associations between aspects of night working and wellbeing outcomes (see Table 8).

In the analyses of non-resident on-call working, having more completely free weekends predicted better work ability and less work-family interference. In addition, a higher frequency of being on-call was associated with a *better* overall rating of general health (see Table 9).

Table 6: Standardized beta weights (and R² values) for the analyses of well-being outcomes in the entire sample (excluding directors, professors, etc.)

	Burnout		Stress		Fatigue after work		General health		Work ability		Combining work & family	
	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.191 ***	.182 ***	.127 ***	.122 **	.161 ***	.146 ***	.128 **	.128 **	.062	.077 §	.203 ***	.198 ***
Do you have some form of flexitime, ... ?	.020	.041	.019	.029	.047	.063	.018	.018	.011	.011	-.076	-.076
How often are your shifts longer than 12 hours ... ?	.062	.075	.069	.091	.051	.059	-.020	-.020	.016	.055	.039	.070
How often is the time off ... between your shifts ... less than 11 hours?	-.007	.015	.064	.063	.059	.078	.009	.009	-.014	-.043	.072	.055
How often do you work weekends on-call (days)?	-.045	-.056	-.001	-.011	-.067	-.079	.003	.003	-.065	-.048	.134 **	.136 *
How often do you work night duty (on-call)?	-.062	-.066	-.097 *	-.081	-.045	-.046	-.077	-.077	-.066	-.013	-.050	-.025
Number of hours worked per week in your employment	-.092 *	-.051	-.015	.027	-.039	.005	-.100 *	-.100 *	-.169 ***	-.114 **	.055	.082
Number of work hours per week without compensation	.132 ***	.164 ***	.152 ***	.167 ***	.121 **	.145 ***	.050	.050	.082 *	.065	.155 **	.148 **
R ²	.070	.116	.065	.108	.064	.115	.034	.060	.055	.106	.128	.156
Attitude to work hours		.388 ***		.290 ***		.350 ***		.313 ***		.314 ***		.265 ***
R ²		.232		.171		.208		.138		.183		.203
Stress		.649 ***		x		.605 ***		.382 ***		.369 ***		.306 ***
R ²		.492		x		.441		.191		.228		.242

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

The upper panel of the table (above the first thick line) shows the results of the analysis before adding either 'Attitude to work hours' or 'Stress' as predictors.

The last two rows show the strength of association between (1) the attitude variable and the outcome variables, after controlling for the working time parameters, age, sex, job grade and specialty and (2) the stress variable and the outcome variables, after controlling for the working time parameters, age, sex, job grade and specialty.

Table 7: Standardized beta weights (and R² values) for the analyses of well-being outcomes in respondents who worked weekends.

	Burnout		Stress		Fatigue after work		General health		Work ability		Combining work & family	
	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.189 ***	.188 ***	.105 *	.109 *	.174 ***	.169 ***	.127 **	.133 **	.115 *	.138 **	.205 ***	.199 ***
Do you have some form of flexitime, ... ?	-.010	.017	.014	.030	-.022	.004	-.018	-.001	-.014	-.016	-.099	-.087
How often are your shifts longer than 12 hours ...?	.083	.089	.012	.020	-.003	-.006	-.008	-.015	.005	.008	.009	.037
How often is the time off ... between your shifts ... less than 11 hours?	.020	.029	.115 *	.109 *	.060	.071	-.001	.012	.006	.000	.019	-.012
How often do you work weekends on-call (days)?	-.043	-.041	-.008	-.010	-.015	-.010	.081	.068	.033	.017	.156 **	.153 *
How often do you work night duty (on-call)?	-.032	-.028	-.046	-.036	-.049	-.048	-.046	-.028	-.050	-.006	-.036	.000
How many hours per month are resident on-call?	-.091	-.076	-.076	-.063	.022	.040	-.016	-.014	-.068	-.054	.015	.036
How many weekends per month, you are completely free ...?	.036	.043	.101 *	.098 *	.055	.048	.000	-.002	.017	.023	.099	.105
Number of hours worked per week in your employment	-.090	-.042	.019	.063	-.017	.025	-.091 *	-.059	-.140 **	-.088 §	.047	.073
Number of work hours per week without compensation	.116 **	.143 **	.152 ***	.166 ***	.103 *	.123 **	.044	.051	.070	.061	.153 **	.142 **
R ²	.067	.119	.078	.121	.053	.108	.029	.064	.044	.101	.152	.192

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

Table 8: Standardized beta weights (and R^2 values) for the analyses of well-being outcomes in respondents who worked nights

	Burnout		Stress		Fatigue after work		General health		Work ability		Combining work & family	
	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.173 **	.168 **	.088	.084	.129 *	.126 *	.078	.083	.109 *	.138 *	.170 **	.145 *
Do you have some form of flexitime, ... ?	-.027	-.001	.018	.035	-.029	.003	-.016	.004	-.003	-.009	-.049	-.041
How often are your shifts longer than 12 hours ...?	.079	.057	.069	.062	-.040	-.067	.038	.022	.039	.033	-.014	.015
How often is the time off ... between your shifts ... less than 11 hours?	.075	.099	.143 *	.146 *	.176 **	.196 **	.004	.019	.019	.018	.067	.052
How often do you work weekends on-call (days)?	-.058	-.049	-.004	-.019	-.083	-.075	.018	.021	.027	.031	.189 **	.191 **
How often do you work night duty (on-call)?	-.058	-.034	-.036	-.010	-.018	.016	-.013	.014	-.071	-.065	-.055	-.003
How many hours per month are res on-call?	-.066	-.051	-.063	-.043	.056	.071	-.075	-.040	-.082	-.080	.022	.021
How much of a night-call is active work?	-.004	-.021	.069	.030	-.002	-.006	-.059	-.070	-.015	.027	-.029	-.063
Are you generally free directly after a night shift?	-.073	-.058	-.160	-.162	-.120	-.113	-.097	-.090	-.071	-.060	-.015	-.029
Are you generally free directly before a night shift?	.032	-.007	.070	.055	.006	-.056	.150	.063	.118	.069	-.006	-.072
Number of hours worked per week in your employment	-.093	-.046	.033	.072	-.020	.024	-.097	-.045	-.125 *	-.060	.074	.094
Number of work hours per week without compensation	.150 **	.173 **	.186 ***	.197 **	.138 **	.153 **	.080	.077	.091	.088	.157 **	.147 *
R^2	.070	.131	.082	.132	.060	.135	.031	.091	.049	.129	.138	.207

Note: $\oint = p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

Table 9: Standardized beta weights (and R² values) for the analyses of well-being outcomes in respondents who worked non-resident on-call

	Burnout		Stress		Fatigue after work		General health		Work ability		Combining work & family	
	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.185 **	.180 **	.166 **	.170 **	.158 **	.148 **	.140 *	.147 *	.085	.096	.214 **	.211 **
Do you have some form of flexitime, ... ?	-.046	-.026	-.063	-.060	-.009	.008	-.032	-.033	-.047	-.048	-.183 *	-.183 *
How often are your shifts longer than 12 hours ...?	.085	.089	.024	.025	.076	.081	.034	-.003	.001	.022	.080	.075
How often is the time off ... between your shifts ... less than 11 hours?	.059	.073	.061	.089	.078	.109	-.036	.010	-.011	.017	.115	.129
How often are you on-call (back up) on average?	-.132 *	-.094	-.060	-.056	-.055	-.028	-.144 **	-.114 *	-.113 *	-.081	-.068	-.045
How often you will be contacted during on-call ..?	.025	.006	.050	.065	.037	.021	.087	.104 §	-.042	-.041	-.040	-.079
How many weekends per month, you are completely free ...?	.033	.024	.086	.061	-.056	.038	.079	.077	.112 *	.128 *	.152 *	.154 *
Number of hours worked per week in your employment	-.169 **	-.107 §	-.003	.049	-.098	-.032	-.148 **	-.084	-.169 **	-.091	.039	.066
Number of work hours per week without compensation	.107 *	.119 *	.157 **	.173 **	.125 *	.137 *	.017	.015	.030	.007	.185 **	.177 **
R ²	.090	.135	.087	.133	.083	.145	.069	.124	.053	.149	.179	.230

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

Working time arrangements as predictors of attitudes

In the analyses of the entire sample, having influence over work hours was a strong predictor of positive attitudes in all three measures. Access to flexitime also strongly predicted positive attitudes towards work hours and was also associated with fewer thoughts about trying to change the work situation. Frequent long shifts (< 12hours) were associated with negative attitudes towards work hours. Working a higher number of unpaid hours was associated with negative attitudes in all three measures (see Table 10).

In the analysis of weekend working, high frequency of weekend working was associated with negative feelings about work (see Table 11).

There were no significant associations between aspects of night working and attitudes (see Table 12).

In the analysis of non-resident on-call working, more frequent on-calls were associated with a more *positive* attitude towards work hours. Having fewer completely free weekends was associated with more thoughts of changing profession, etc. (see Table 13).

Table 10: Standardized beta weights (and R² values) for the analyses of attitude outcomes in the entire sample (excluding directors, professors, etc.)

	Feelings about work		Attitude to work hours		Thoughts of changing	
	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.212 ***	.214 ***	.280 ***	.246 ***	.163 ***	.163 ***
Do you have some form of flexitime, ... ?	-.012	.007	.122 **	.135 ***	.057	.082 *
How often are your shifts longer than 12 hours ...?	.021	.061	.129 **	.131 *	.050	.090
How often is the time off ... between your shifts ... less than 11 hours?	-.036	-.050	.080 §	.086 §	-.065	-.062
How often do you work weekends on-call (days)?	.023	.016	.026	.018	.031	.010
How often do you work night duty (on-call)?	-.033	-.022	-.057	-.068	-.021	-.035
Number of hours worked per week in your employment	-.086 *	-.049	-.010	-.008	-.030	-.016
Number of work hours per week without compensation	.074 *	.090 *	.112 **	.125 ***	.052	.075 *
R ²	.053	.100	.205	.245	.046	.105
Attitude to work hours		.331 ***		x		.261 ***
R ²		.183		x		.157
Stress		.418 ***		.246 ***		.343 ***
R ²		.255		.297		.211

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

The upper panel of the table (above the first thick line) shows the results of the analysis before adding either 'Attitude to work hours' or 'Stress' as predictors. The last two rows show the strength of association between (1) the attitude variable and the outcome variables, after controlling for the working time parameters, age, sex, job grade and specialty and (2) the stress variable and the outcome variables, after controlling for the working time parameters, age, sex, job grade and specialty.

Table 11: Standardized beta weights (and R² values) for the analyses of attitude outcomes in respondents who worked weekends

	Feelings about work		Attitude to work hours		Thoughts of changing	
	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.221 ***	.220 ***	.262 ***	.222 ***	.140 **	.144 **
Do you have some form of flexitime, ... ?	-.050	-.020	.098 *	.104 *	.044	.073
How often are your shifts longer than 12 hours ...?	.020	.048	.089	.078	.029	.069
How often is the time off ... between your shifts ... less than 11 hours?	-.064	-.078	.103 *	.115 *	-.033	-.061
How often do you work weekends on-call (days)?	.120 *	.117 *	-.025	-.019	.021	.027
How often do you work night duty (on-call)?	.017	.011	-.027	-.044	-.004	-.012
How many hours per month are resident on-call?	-.066	-.045	-.009	-.004	-.026	.010
How many weekends per month, you are completely free ...?	.052	.063	.069	.053	.081	.081
Number of hours worked per week in your employment	-.107 *	-.072	-.018	-.020	-.045	-.031
Number of work hours per week without compensation	.055	.076	.151 ***	.163 ***	.069	.088 *
R ²	.073	.120	.189	.244	.047	.098

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

Table 12: Standardized beta weights (and R² values) for the analyses of attitude outcomes in respondents who worked nights

	Feelings about work		Attitude to work hours		Thoughts of changing	
	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.202 **	.193 ***	.230 ***	.209 ***	.114 *	.123 *
Do you have some form of flexitime, ... ?	-.064	-.038	.096 §	.121 *	.063	.106 §
How often are your shifts longer than 12 hours ...?	.066	.052	.092	.083	-.027	-.004
How often is the time off ... between your shifts ... less than 11 hours?	-.062	-.045	.189 **	.190 **	-.052	-.075
How often do you work weekends on-call (days)?	.121 *	.129 *	.000	-.010	.036	.052
How often do you work night duty (on-call)?	-.019	-.003	-.090	-.074	.033	.038
How many hours per month are res on-call?	-.072	-.024	-.016	.003	-.063	.011
How much of a night-call is active work?	.062	.006	-.045	-.124	-.093	-.067
Are you generally free directly after a night shift?	-.082	-.068	-.104	-.119	.105	.101
Are you generally free directly before a night shift?	.059	.008	-.001	.004	-.030	-.098
Number of hours worked per week in your employment	-.065	-.029	-.048	-.030	.013	.024
Number of work hours per week without compensation	.133 **	.153 **	.144 **	.132 **	.102 *	.110 *
R ²	.073	.133	.170	.216	.052	.111

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

Table 13: Standardized beta weights (and R² values) for the analyses of attitude outcomes in respondents who worked non-resident on-call

	Feelings about work		Attitude to work hours		Thoughts of changing	
	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.268 ***	.260 ***	.288 ***	.273 ***	.134 *	.114 *
Do you have some form of flexitime, ...?	-.131 *	-.092	.051	.038	.045	.101
How often are your shifts longer than 12 hours ...?	-.018	.015	.086	.055	.058	.093
How often is the time off ... between your shifts ... less than 11 hours?	.038	.043	.176 **	.204 **	-.020	-.044
How often are you on-call (back up) on average?	-.037	-.012	-.164 **	-.170 **	-.091	-.043
How often you will be contacted during on-call ..?	.025	.018	-.007	.003	.030	-.016
How many weekends per month, you are completely free ...?	.093	.089	.083	.070	.108 *	.106 *
Number of hours worked per week in your employment	-.115 *	-.048	-.037	-.019	-.058	-.022
Number of work hours per week without compensation	.084	.100	.118 *	.145 **	.063	.102 §
R ²	.087	.148	.225	.267	.060	.132

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

Working time arrangements as predictors of patient care

In the analyses of the entire sample, lacking influence over work hours was a significant predictor of worrying about making a mistake, of feeling that workload increased the risk of malpractice and of sufficient continuity of care. Access to flexitime also predicted sufficient continuity of care. Working long shifts (> 12 hours) was also associated with more concerns about malpractice related to workload. Working many quick returns of < 11 hours was associated with increased likelihood of having being reported for malpractice in the last 5 years. Working weekend on-calls was positively associated with being reported. Higher weekly work hours were associated with increased likelihood of having being reported in the last 5 years. Working more unpaid hours was associated with worrying about making a mistake and greater concerns about malpractice related to workload (see Table 14).

In the analysis of weekend working, lack of completely free weekends was associated with greater likelihood of being reported. However, working more hours on-call was associated with *lower* likelihood of being reported (see Table 15).

In the analysis of night working, working more hours resident on-call was associated with *lower* likelihood of being reported. Being free directly after a night shift was associated with *poorer* continuity of care (see Table 16).

In the analyses of non-resident on-call working, a higher frequency of being contacted when on-call was associated with a *lower* likelihood of being reported. Having fewer completely free weekends was associated with greater likelihood of having being reported (see Table 17).

Table 14: Standardized beta weights (and R² values) for the analyses of patient care outcomes in the entire sample (excluding directors, professors, etc.)

	Risk of mistake stress		How often workload risks malpractice?		Reported in last 5 years? #		Continuity of care	
	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.124 **	.118 **	.133 **	.140 ***	-.128	-.112	.125 **	.079 *
Do you have some form of flexitime, ... ?	-.020	.001	.035	.062	.183	.155	.122 **	.103 **
How often are your shifts longer than 12 hours ...?	.031	.003	.120 *	.122 *	-.130	-.176 §	.019	-.050
How often is the time off ... between your shifts ... less than 11 hours?	-.032	.046	-.018	-.003	.161 *	.187 *	-.077	-.013
How often do you work weekends on-call (days)?	.022	-.001	.007	-.014	.270 *	.333 *	-.008	-.019
How often do you work night duty (on-call)?	.023	-.025	-.034	-.018	-.084	-.081	.052	-.013
Number of hours worked per week in your employment	-.098 *	-.072	-.005	.018	.024 *	.021 *	.025	-.014
Number of work hours per week without compensation	.061	.116 **	.164 ***	.193 ***	.126	.083	.004	.069
R ²	.025	.123	.076	.127	.038	.134	.053	.147
Attitude to work hours		.167 ***		.244 ***		.183 *		.096
R ²		.139		.167		.141		.134
Stress		.398 ***		.385 ***		.168		.085
R ²		.265		.260		.136		.137

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

'Reported in the last 5 years' was analysed using ordinal regression and hence parameter estimates are provided instead of Beta weights. The upper panel of the table (above the first thick line) shows the results of the analysis before adding either 'Attitude to work hours' or 'Stress' as predictors. The last two rows show the strength of association between (1) the attitude variable and the outcome variables, after controlling for the working time parameters, age, sex, job grade and specialty and (2) the stress variable and the outcome variables, after controlling for the working time parameters, age, sex, job grade and specialty.

Table 15: Standardized beta weights (and R² values) for the analyses of patient care outcomes in respondents who worked weekends

	Risk of mistake stress		How often workload risks malpractice?		Reported in last 5 years?		Continuity of care	
	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.134 **	.148 **	.117 **	.143 **	-.262 *	-.208	.134 **	.081
Do you have some form of flexitime, ... ?	-.018	.001	.036	.057	.220 §	.157	.089 *	.082
How often are your shifts longer than 12 hours ...?	.050	.029	.139 *	.133 *	-.023	-.101	-.033	-.090
How often is the time off ... between your shifts ... less than 11 hours?	-.025	.020	.002	-.012	.239 **	.264 **	-.066	.019
How often do you work weekends on-call (days)?	-.032	-.020	-.032	-.036	-.121	-.020	-.070	-.056
How often do you work night duty (on-call)?	.017	-.007	-.023	-.007	-.051	-.027	.034	-.005
How many hours per month are resident on-call?	-.090	-.102 §	-.089	-.051	-.654 **	-.560 **	.058	-.002
How many weekends per month, you are completely free ...?	.068	.069	.065	.079	.321 *	.372 **	.086 §	.070
Number of hours worked per week in your employment	-.104 *	-.070	.010	.037	.024 *	.020	.013	-.019
Number of work hours per week without compensation	.059	.100 *	.179 ***	.192	.140	.097	.025	.095 *
R ²	.038	.125	.087	.143	.068	.162	.062	.149

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

'Reported in the last 5 years' was analysed using ordinal regression and hence parameter estimates are provided instead of Beta weights.

Table 16: Standardized beta weights (and R² values) for the analyses of patient care outcomes in respondents who worked nights

	Risk of mistake stress		How often workload risks malpractice?		Reported in last 5 years?		Continuity of care	
	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.100 §	.116 *	.114 *	.117 *	-.235	-.166	.087	.052
Do you have some form of flexitime, ... ?	-.010	.007	.066	.088	.153	.032	.054	.059
How often are your shifts longer than 12 hours ...?	-.022	-.017	.118	.093	-.024	-.075	-.067	-.077
How often is the time off ... between your shifts ... less than 11 hours?	-.015	.009	.084	.098	.306 **	.316 **	-.004	.035
How often do you work weekends on-call (days)?	-.009	.018	-.090	-.089	.088	.182	-.036	-.033
How often do you work night duty (on-call)?	.003	.003	-.010	.048	-.201	-.185	.027	-.005
How many hours per month are res on-call?	-.083	-.085	-.085	-.060	-.984 ***	-1.061 **	-.005	-.062
How much of a night-call is active work?	-.066	-.003	.009	-.030	-.034	-.061	.021	.066
Are you generally free directly after a night shift?	-.062	-.030	-.103	-.136	-.048	-.094	-.008	.061
Are you generally free directly before a night shift?	-.034	-.104	.027	-.020	-.040	-.010	-.265 **	-.293 ***
Number of hours worked per week in your employment	-.052	-.020	.019	.048	.026 *	.026	.047	-.003
Number of work hours per week without compensation	.105 *	.139 **	.224 ***	.208 ***	.265	.199	.013	.077
R ²	.060	.125	.108	.172	.090	.188	.097	.185

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

'Reported in the last 5 years' was analysed using ordinal regression and hence parameter estimates are provided instead of Beta weights.

Table 17: Standardized beta weights (and R² values) for the analyses of patient care outcomes in respondents who worked non-resident on-call

	Risk of mistake stress		How often workload risks malpractice?		Reported in last 5 years?		Continuity of care	
	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj
Can you influence how and when your working hours are scheduled?	.095	.104	.117 *	.132 *	-.074	-.102	.056	.010
Do you have some form of flexitime, ... ?	-.072	-.066	-.015	.010	.018	.043	.133 *	.133 *
How often are your shifts longer than 12 hours ...?	.010	-.035	.171 *	.166 *	-.295 *	-.279 *	-.114	-.147 *
How often is the time off ... between your shifts ... less than 11 hours?	.110	.136 §	-.051	-.050	.298 *	.307 **	.057	.071
How often are you on-call (back up) on average?	-.048	-.026	-.055	-.023	-.130	-.096	.028	.034
How often you will be contacted during on-call ...?	-.001	.001	-.003	-.023	-.138	-.239 **	-.054	-.037
How many weekends per month, you are completely free ...?	.076	.061	.035	.039	.266 *	.342 *	.106	.085
Number of hours worked per week in your employment	-.134 *	-.073	-.032	.026	.027 §	.029	.007	-.018
Number of work hours per week without compensation	.008	.049	.130 *	.154 **	.263	.206	.010	.055
R ²	.034	.121	.064	.152	.056	.219	.048	.144

Note: § = $p < .06$, * = $p < .05$, ** = $p < .01$, *** = $p < 0.001$.

'Reported in the last 5 years' was analysed using ordinal regression and hence parameter estimates are provided instead of Beta weights.

Attitudes towards work hours as a predictor of sleep, wellbeing, attitude and patient care outcomes

In these two-step analyses, age, gender, job grade and specialism were entered in the first step, working time arrangements were entered in the second step and the attitudes towards work hours were entered in the third step. Thus, the analyses sought to determine whether the latter could account for additional variance in the outcomes, over and above the variance accounted for by the working time parameters. In each case, attitudes significantly predicted the outcome variable, after controlling for work schedule characteristics (see lower panels of Tables 1, 5, 9 & 13,).

In the analyses of the sleep outcomes, attitudes were a highly significant predictor of all six sleep outcomes. However, the pattern of significant effects associated with the working time parameters remained largely unchanged after adding attitudes as a predictor (upper panels of Tables 1, 5, 9 & 13 show the effects *before* attitudes were added as a predictor). Most notably, the associations between influence and two of the outcomes (getting enough sleep and overall rating of sleep) were no longer significant.

Similarly, while attitudes were highly significant predictors of wellbeing, the addition of this predictor produced broadly unchanged results, although the associations between influence and two of the outcomes (general health and work ability) were no longer significant.

Attitudes towards work hours were highly significantly associated with feelings about work and thoughts of changing the work situation. However, once again, following the addition of this predictor the associations with the working time parameters remained largely unchanged.

Attitudes towards work hours was a strong predictor of two out of the four patient care related variables, the association with having been reported in the last 5 years was moderate and the association with continuity of care did not reach significance. While the pattern of results was generally similar to the original analyses, the associations between influence and the outcome variables failed to reach significance when attitudes was added as a predictor.

Stress as a predictor of sleep, wellbeing, attitude and patient care outcomes.

In a similar manner to the previous set of analyses, stress was entered as an additional predictor of each of the outcome variables. In general, the addition of stress as a predictor produced a broadly similar pattern of results as reported previously for the addition of attitudes towards work hours. In the analyses of sleep outcomes, stress was a highly significant predictor of all six sleep outcomes. The pattern of results was largely unchanged from the original analysis by the inclusion of stress as a predictor. However, the associations between influence and three of the predictors (thoughts about work, get enough sleep and overall rating of sleep) were no longer significant.

In the analyses of wellbeing outcomes, stress was a highly significant predictor of wellbeing outcomes. The pattern was relatively unchanged from the original analysis although the associations between influence and two of the outcomes (general health and work ability) became non-significant. In the analyses of the attitude variables, while stress was a highly significant predictor of all three outcomes, the pattern of results was otherwise largely unchanged from the original analysis.

In the analyses of the patient care-related variables, stress was highly significant predictor of two out of the four outcomes, but the associations with having been reported in the last 5 years and continuity of care were not significant. The pattern of results was mostly unchanged from the original analysis, with the following exceptions. The associations between two of the predictors (influence and unpaid hours) and risk of mistake stress were no longer significant, and the association between frequency of long shifts and malpractice relating to workload was also no longer significant.

Discussion

The majority of respondents expressed positive attitudes about their working time arrangements. This may be due in part to a reduction in the length of the working week over the last two decades, as reflected in the proportion of Swedish doctors working more than 40 hours per week (Bejerot, et al., 2011). On the other hand, while the proportion of shift working doctors expressing negative attitudes towards their work hours was quite small, it was nevertheless somewhat higher than the equivalent statistic recently obtained from a representative sample of all Swedish shift workers (Åkerstedt, et al., 2012). This may be linked to the finding that the proportion of shift working doctors' reporting no influence over their work hours was substantially higher than the equivalent statistic for all Swedish shift workers. In comparison with the general working population, doctors reported higher levels of stress and emotional exhaustion (burnout), and they were also more likely to report getting insufficient sleep. However, doctors reported better quality (i.e. less disturbed) sleep. The latter difference may reflect doctors' higher socio-economic status (c.f. Arber, Bote, & Meadows, 2009).

A substantial proportion of respondents reported experiencing inter-shift intervals less than the minimum specified by the European Working Time Directive. There was considerable variability in the amount of on-call work reported (both resident on-call and non-resident on-call). A substantial proportion of respondents who worked nights worked a whole day immediately prior to a night shift or the whole day after a night shift. Working the whole day before a night shift will severely restrict opportunities for a prophylactic sleep in preparation for a night shift. Working the whole day after a night shift will severely restrict opportunities for recovery, and will increase the likelihood of having to work while extremely fatigued. However, in this case the majority of those who worked a whole day before or after a night shift reported light workloads during their night shifts, giving them opportunity for rest during their shift. Moreover, those who more frequently worked the whole day before or after night shifts tended to work night shifts only relatively infrequently. Nevertheless, it is important to note that severe fatigue is likely to result from working a whole day before or after a busy night shift, albeit that such circumstances were apparently rare in the current sample.

Regarding medical speciality, ear, nose & throat (ENT) specialists had the most negative attitudes towards their work hours. They were among the most likely to lack influence over their work hours, experience quick returns, work long shifts, work a lot of on-call and work long weekly hours. Orthopaedic specialists had the second most negative attitudes towards their work hours. They reported the lowest amounts of influence over their work hours and were among the most likely to lack access to flexitime and to work many long shifts. Cardiologists had the third most negative attitudes towards their work hours. They had relatively low levels of influence over their work hours, lacked access to flexitime, and often worked weekends and non-resident on-call. Negative attitudes towards work hours were also relatively common among specialists in internal medicine, surgery and anaesthesia. Surgeons were among the most likely to lack influence or flexibility with respect to work hours, experience quick returns, work on-call and they also worked the longest weekly hours on average. Anaesthetists also tended to lack influence or flexibility with respect to work hours, do a lot of on-call work and they were the most likely to work long shifts.

It is possible that the difference between specialties, with respect to attitudes towards work hours, is at least partly related to gender. When the association between specialty and attitudes was examined

separately for women and men (not reported above¹), only the former was statistically significant. Women working in surgery, anaesthesia and internal medicine were substantially more likely to have negative attitudes towards their work hours than their male counterparts. It may be that the high proportion of negative attitudes associated with certain specialities may reflect the attitudes of women working in what are traditionally male-dominated specialities, where the work schedules have been largely designed by and for men. The problem for women working in such specialities is that they may prefer different working time arrangements to their male counterparts e.g. working part-time and / or varying their work hours in order to balance work and family commitments.

In the analyses by region, respondents in Västra Götaland reported the lowest levels of influence over work hours, while influence was highest in the category 'Svea/Götaland'. Respondents in Uppsala did the most on-call work (resident and non-resident on-call) and worked the most unpaid hours per week. Respondents in the North of Sweden worked the fewest unpaid hours per week. They were most likely to work the whole day before or after a night shift, while respondents in Stockholm were least likely to. Respondents in Stockholm worked the fewest hours resident on-call per month and were least likely to work frequent non-resident on-calls.

It should be noted that these results reflect the situation as it was in 2007. The regional picture is likely to have altered in subsequent years, as and when local management policy and practices have evolved. The higher levels of unpaid overtime in Uppsala may reflect the strong research culture in that region. Additional analyses (not reported above) indicated that respondents in Uppsala spent the most time on research activities, among all the regions. When amount of research time was subtracted from the amount of unpaid hours, there was no longer any statistically significant difference between the regions. The strong research culture in Uppsala may also account for the higher levels of on-call work in that region, as compensation for working on-call can often take the form of being granted additional time for research.

There were few differences in the comparisons of employees in the public and private sectors. Public sector workers were more likely to have access to flexitime. In the comparisons of respondents who worked non-standard hours, the only difference was that public sector workers were more likely to work non-resident on-call. The type of work undertaken in the two sectors differed somewhat, with a greater proportion of private sector employees worked in general medicine (30%, as opposed to 20% of public sector employees) and a smaller proportion working non-standard hours (45% *vs.* 71%).

In the analyses of associations between working time parameters and outcomes, one of the most striking findings was the wide spread strong association between having influence over work hours and positive outcomes. Access to flexitime also predicted several positive outcomes. There is potentially important distinction to be drawn between *having the opportunity* to influence one's work hours and *actually utilizing* such opportunities for flexibility. The questions in the current survey relating to influence over work hours and flexitime did not explicitly emphasise this distinction and could therefore be considered somewhat ambiguous in this regard. Work time control has the potential to enhance an employee's experience of work itself i.e. through enhanced job autonomy. Thus, merely having the genuine possibility to influence work hours may reduce stress, even if the actual work hours are not

1 When the sample is broken down by speciality and gender some cells have very low numbers of respondents, making it difficult to examine the issue statistically.

changed (Garde et al., 2012). However, under some circumstances flexibility can be associated with the breakdown of work-nonwork boundaries. In particular, when work loads are high and there are ambiguous norms about work hours, there is a risk that the employee may feel pressured to restructure their personal time to work (Kossek & Lee, 2008). Under such circumstances flexible work schedules may foster a culture of overwork. The successful implementation of a flexible work schedule policy depends on it being supported by informal supervisory practice. If the policy only exists on paper but not in practice then the benefits associated with increased job autonomy and schedule control will be lost (Kossek & Michel, 2010).

Long shifts were associated with insufficient sleep, poor overall ratings of sleep, negative attitudes towards work hours, thoughts of changing the work situation and concerns about workload risking malpractice. Long weekly hours were associated with increased likelihood of being reported for malpractice. Working longer unpaid hours was associated with poorer sleep outcomes, greater burnout, more stress, worse ratings of fatigue, greater work-family conflict, more negative attitudes, and greater concerns regarding the risk of mistakes, workload and malpractice; all in all suggesting a link between working long unpaid hours and high workload. Quick returns (< 11 hours; the minimum inter-shift interval specified by the European Working Time Directive) were also associated with greater likelihood of being reported.

Weekend working (resident on-call) was associated with poorer quality sleep, greater stress and more negative attitudes. These associations possibly reflect the importance of weekend rest for detaching and disengaging from thoughts about work. Unsurprisingly, weekend working was linked to greater work-family conflict. There was also an association between frequency of weekends that involved working and being reported for malpractice. By way of a possible explanation, it is notable that weekend working is exclusively on-call work, when a relatively small number of doctors are responsible for a large number of patients throughout a hospital. Doctor-patient communication (which is the main source of malpractice complaints) is likely to be especially poor under such circumstances. In contrast to the positive association between number of weekends worked and likelihood of being reported, there was also a *negative* association between the number of hours worked resident on-call and the likelihood of being reported. With regard to the apparent contrast between these two findings, it should be noted that in the latter case it was the total number of hours worked on-call (i.e. including both weekend work and night work) that was being measured. There was a similar (negative) association in the analysis of night working; and being frequently contacted when *non-resident* on-call was also associated with a lower likelihood of being reported. The reasons for these negative associations between the amount of on-call work and likelihood of being reported are unclear. On-call work involves dealing with a broad range of patient cases, including those outside the individual doctors' own medical speciality. Thus it could be argued that on-call work is an important part of doctors' training, developing their all-round competence and thereby reducing their chances of being reported.

A general problem when it comes to interpreting the findings relating to being reported is that respondents were asked how many times they had been reported *in the last five years*. It is of course quite possible that in many cases, the working time arrangements reported by respondents at the time of the survey were different from those at the time of the incident for which they were reported.

Participants who worked the day before a night shift (resident on-call), as well as those who were actively working during much of the night shift, were more likely to report feeling exhausted upon awakening. This suggests that the combination of high demands and night work leads to insufficient recovery. Those who worked the day before a night shift also reported better continuity of care. This is an example of the sort of trade-offs between the requirements of fatigue management and patient care that are the source of much debate, when it comes to placing limits on doctors work hours. In the same vein, it is notable that in the analysis of non-resident on-call working, high frequency of long shifts was associated with better continuity of care and lower likelihood of being reported for malpractice.

Among those working non-resident on-call, having more completely free weekends predicted better work ability, less work-family interference, fewer thoughts about changing profession, etc. and lower likelihood of being reported for malpractice. However, higher frequency of non-resident on-call working was associated with *better* sleep, *better* general health and a *more positive* attitude towards work hours. By way of a possible explanation, it is notable that when doctors' work non-resident on-call they are usually compensated with additional time off and sometimes have greater control over their work hours. These compensatory benefits may be the reason for the positive outcomes associated with more non-resident on-call working.

The analyses that examined attitudes towards work hours and stress as predictors, suggest broadly similar conclusions. Inclusion of these predictors tended to reduce the strength of the previously observed associations, but the overall pattern of results remained broadly similar. The associations between influence over work hours and the outcomes, although reduced in strength compared to the original analyses, mostly remained significant. Thus it appears that attitudes and stress both account for substantial additional portions of variance in the majority of outcomes, over and above that accounted for by the working time parameters. The importance of attitudes towards work hours as a predictor of a wide range of outcomes highlights the importance of matching work hours to individual needs and preferences, not only in terms of the impact on psycho-social variables (e.g. satisfaction, work-family balance) but also in promoting positive health and safety outcomes.

One of the main strengths of the current study was that was based on a relatively large and relatively homogeneous sample of doctors. The response rate of 53% compares reasonably well with previous large-scale surveys of doctors (e.g. Gander, et al., 2007; Heponiemi, et al., 2008; Tucker, et al., 2010 - 63%, 57% & 46%, respectively). The questionnaire included a number of well-validated measures of health and well-being. However, it also included some single item measures. The cross-sectional nature of the study limits the possibility for inferring causal mechanisms. Moreover, it relied entirely on self-report data, making it potentially subject to subjective biases and vulnerable to the problems of common method variance.

The current findings provide some of the first detailed information regarding the nature and impact of doctors' work hours in Sweden. The appropriate design of work schedules will help to maintain and promote doctors' enthusiasm and commitment to their chosen profession. Moreover, it will help safeguard doctors' own well-being, help them to maintain high standards of performance and patient care, reduce the risk of errors and concomitantly reduce the risk of patient harm.

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APPENDIX 1: QUESTIONNAIRE ITEMS

A: Background

Only choose one alternative per question. If you have several jobs or recently changed workplace, adapt your answer to the job where you currently work most hours per week.

Current job title

Junior doctor, registered

ST-doctor

Medical specialist

Consultant (senior doctor?)

Director

Professor/lecturer

Other:

Type of work place

University hospital

Regional hospital

County hospital ("länssjukhus")

Other hospital

Hospital area

GP/Health centre

Smaller practice

Consultancy

Other:

Mode of operation for the organisation where you work

State organisation

District/city/region organisation

Corporatized organisation

Private organisation

Self employed/own business

Other:

The geographical area where your work place is situated

Stockholms läns landsting

Landstinget Blekinge

Landstinget i Dalarna

Landstinget i Uppsala län

Region Skåne

Landstinget i Gävleborg

Landstinget i Sörmland

Landstinget Halland

Landstinget i Västernorrland

Landstinget i Östergötland

Västra Götalandsregionen

Jämtlands läns landsting
Landstinget i Jönköpings län
Landstinget i Värmland
Västerbottens läns landsting
Landstinget i Kronoberg
Örebro läns landsting
Norrbottens läns landsting
Landstinget i Kalmar län
Landstinget i Västmanland
Gotlands kommun

The specialist group where you are currently working

General medicine
Anaesthesiology
Pediatrics
Internal medicine
Cardiology
Geriatrics
Surgery
Orthopedics
Clinical laboratory medicine
Gynecology
Psychiatry
Radiology
Oncology
Eye
Ear nose and throat
Other specialties

The following questions are used to statistically calculate the significance of age, gender and marital status

- Number of years as a registered doctor. Only type whole years, if less than 1 year type 1
- Number of years at current workplace. Only type whole years, if less than 1 year type 1
- Year of birth (four numbers)
- Gender
Female
Male

Number of hours worked per week in your employment

Only use numbers. Type number of whole hours, for example 40

- Number of hours per week at work, in service
- Number of hours per week at work, without compensation

Working time arrangements

Can you influence how and when your working hours are scheduled?

Yes

Yes, to some extent

No

Do you have some form of flextime, which means you can adapt your working hours to suit your own needs?

Yes

Yes, to some extent

No

What kind of working hours do you have?

Only ordinary working hours (weekdays 06-21) – Move on to question 83

Mixed ordinary working hours (weekdays 06-21) with on-call duty or standby duty

Length of the shifts

a. How often are your shifts longer than 12 hours total (including any on-call duty)?

b. How often is the time off (leave) between your shifts (including any on-call duty) less than 11 hours?

c. How often is the time off (leave) between your shifts (including any on-call duty) less than 8 hours?

d. How often do you work weekends on-call duty (days)

e. How often do you work night duty?

Never

1-2 times/month

3-4 times/month

5-6 times/month

More than 6 times/month

How many hours per month are you on-call duty on average? Answer in whole hours, only use digits

How much of a night duty shift is active work?

All, or most of the shift

About three-quarters of the shift

About half of the shift

About one-quarter of the shift

Less than one-quarter of the shift

None

Leave around a night shift

a. Are you generally free directly after a night shift?

b. Are you generally free directly before a night shift?

Yes, completely

No, I work less than half of a day

No, I work a half day
No, I work a whole day

How often are you on-call on average?

Never
1-4 days/month
5-9 days/month
10-14 days/month
15 or more days/month

How often you will be contacted during call duty, on average per day?

Not once
1 time
2-3 times
4-5 times
More than 5 times

How many weekends per month, are you completely free (both Saturday and Sunday)?

All weekends
3 weekends
2 weekends
1 weekend
0 weekends

SLEEP

Have you experienced any of the following symptoms during the past three months?

- a. Difficulty falling asleep
- b. Repeated awakenings with difficulty falling back asleep
- c. Too early (final) awakening
- d. Interrupted/restless sleep
- e. A feeling of being exhausted when waking up
- f. Less sleep than 6 hours
- g. Difficulty sleeping due to thoughts about work

Never
Rarely/occasionally
Sometimes/a few times per month
Often/1-2 times per week
Most of the time/3-4 times per week
Always/5 times or more per week

Do you think you get enough sleep?

Yes, definitively enough
Yes, basically enough
No, not really enough
No, clearly not enough
No, far from enough

How would you rate your sleep in general?

Very good

Rather good

Neither good nor bad

Rather poor

Very poor

Wellbeing

Below are some statements about feelings that may arise in connection with work. Specify how often you have felt these ways in connection with your work

- a. I feel emotionally drained by my work
- b. I feel completely exhausted when the workday is over
- c. I feel tired getting up in the morning to face a new day at work
- d. Working a whole day is really trying for me
- e. I feel run-down by my work

Every day

A few times a week

Once a week

A few times per month

Once a month

A few times a year or less

Never

How have you felt during the last three months?

- a. I have days when I feel overactive all the time
- b. I have days when I feel very pressured, on the verge of what I am capable of
- c. I find it hard to relax in my spare time
- d. I am often tense
- e. I often have disturbing thoughts
- f. I am often restless
- g. I feel well rested after a few days of taking it easy

Not at all

Sometimes

Rather often

Almost all the time

Fatigue and health

- a. Do you feel physically tired after work?
- b. Do you feel mentally tired after work?
- c. Are you so tired after work that you find it hard to do things, such as working out, pursuing a hobby or meeting friends?
- d. Do you have symptoms that you perceive to be psycho-somatic (headache, upset stomach, dizziness, etc.)?
- e. Do you have cognitive problems that you perceive to be related to stress (memory loss, concentration, depression, etc.)?

Yes, often
Yes, rather often
Yes, sometimes
No, rarely
Almost never

How would you rate your general health?

Very good
Good
Neither good nor bad
Rather poor
Very poor

We assume that your working ability, when it was at its best, is valued with 10 points. What score would you give your current working ability? (1 means that you are not able to work at all and 10 that your work is at its best right now.)

1 Can not work at all
2
3
4
5
6
7
8
9
10 My working ability has never been better

Combining work with responsibility for children. Only answer this question if you have children at home.

How well can you combine your work with your responsibilities for your children and family?

Very well
Rather well
Not very well
Not at all

ATTITUDES

What are your feelings about your work when you're on your way there?

I feel happy and satisfied with the idea of the work that awaits
I have a pretty good feeling about my work
I have neither positive nor negative feelings about my work
I feel a certain unease about my work
I feel a strong dislike about my work

What do you feel about your working hours?

Very positive

Rather positive

Neither positive nor negative

Rather negative

Very negative

During the last year, have you thought about...

a. ... changing profession

b. ... changing employer

c. ... changing workplace

d. ... changing special orientation

e. ... reducing the direct patient care

No

Yes, but I lack the possibility

Yes, and I have the possibility

Medical error / malpractice

The following questions are about the risk of malpractice

Do you feel the risk of making mistakes in your work as a mental stress?

No, never

No, rarely

Sometimes

Yes, often

Yes, constantly

How often do you have a workload that you feel increases the risk of malpractice?

Daily

Every week

Every month

Less often

During the past five years, have you ever been reported in your work?

No

Once

Two to three times

More than three times

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