

Reducing non-clinical working hours of junior doctors could benefit patient outcomes

Dear Editor,

An 80-hour duty limit for residents was first introduced by the Accreditation Council for Graduate Medical Education (ACGME) in 2003, with the further addition of a 16-hour continuous duty period limit for first-year residents in 2011. Prior studies¹ have demonstrated an association between longer working hours and increased risk of mental illness,² attentional failures,³ and medical errors.⁴ However, because of a lack of granularity in the definition of duty hours and subsequent studies evaluating these regulations, the role of non-clinical working hours as a predictor of patient and physician outcomes has yet to be defined. We aimed to evaluate the nature of the relationship between working hours and patient safety, with particular attention to the effect of non-clinical working hours.

The entire junior doctor population of Singapore, defined as physicians employed by public healthcare institutions currently in training or yet to enter formal postgraduate training, was invited to participate in this study via direct email to their official email addresses. Participation in the survey was fully anonymous. Ethical approval was obtained from the National University of Singapore Institutional Review Board, and the requirement for informed consent was waived. In addition, these doctors were invited via direct email to participate in an in-depth interview that aimed to explore the lived experiences of junior doctors in Singapore through a semi-structured interview guide. Participation was voluntary, and informed consent was obtained through Zoom, a password-protected video-conferencing platform.

The following items were collected via electronic survey: (1) demographic attributes; (2) employment details; (3) working hours and conditions, non-clinical duties (defined as administrative, educational and mandated research), and call duties; (4) outcome metrics, such as the number of medical errors with the classification of error severity based on the widely used Clavien-Dindo approach; (5) whether respondents logged working hours accurately, and reasons for doing so/not doing so; (6) the Pittsburgh Sleep Quality Index (PSQI); (7) the Patient Health Questionnaire-2 (PHQ-2); (8) the Satisfaction of Employees in Health Care (SEHC) tool; and (9) opinions regarding factors which most affected their job satisfaction and perceptions of adequate compensation, via an open-ended question.

SPSS Statistics version 26.0 (IBM Corp, Armonk, US) was used for the statistical analysis of quantitative data. Analyses comparing means between groups—where errors per year were the dependent variable—were performed with non-parametric tests. Negative binomial regression models were specified to ascertain the effects of clinical hours and non-clinical hours on the incidence rate ratio (IRR) of medical errors. Models were adjusted for sex, age, marital status, discipline, designation, type of rostering, type of call system, number of days off per month, and whether the respondent had >4 calls per month.

A total of 1,117 unique responses were received and used in the final analysis, representing a response rate of 26.0%. More than half of the respondents were female (576, 51.6%), single (802, 71.8%), had 1–5 years of working experience (878, 78.6%), and had outstanding mandatory service obligations (801, 71.7%). On average, junior doctors reported working 71.79 clinical hours (median=72, standard deviation [SD]=16.29) and 8.44 non-clinical hours (median=5, SD=10.06) per week. Junior doctors who were rostered to a night float system worked fewer hours than those rostered to a traditional 24-hour call system (72.4 versus 74.9 clinical hours). The average number of self-reported medical errors per year was 3.09 (median=1, SD=12.90, interquartile range 0.33–2.50).

Two negative binomial regression models were specified to explore the relationship between working hours and self-reported medical errors. The negative binomial model with only clinical and non-clinical hours as covariates was statistically significant, $\chi^2(2)=50$, $P<0.001$. Akaike's Information Criterion was 6591, an improvement over a previously specified Poisson regression model with the same covariates. For every additional clinical hour worked per week, 1.008 times more medical errors were reported (95% confidence interval [CI] 1.007–1.009, $P<0.001$). For every additional non-clinical hour worked per week, 1.018 times more medical errors were reported (95% CI 1.017–1.019, $P<0.001$).

The adjusted binomial regression model was also statistically significant, $\chi^2(20)=155$, $P<0.001$. Akaike's Information Criterion was 6521, an improvement over the prior model. In addition to clinical and non-clinical hours, designation and marital status were significant predictors of medical error. Parameter estimates are shown in the online Supplementary Table S1.

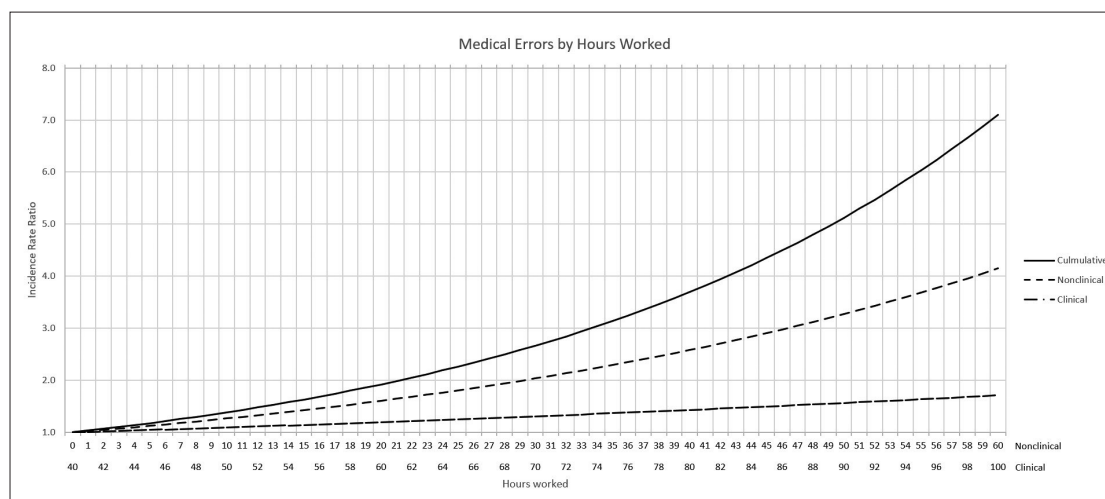


Fig. 1. Graphical presentation of the extrapolated results of the negative binomial regression.

On logistic regression, longer non-clinical hours were also associated with a decreased likelihood of good sleep quality as measured by PSQI (95% CI 0.966–0.991, $P=0.001$) and an increased likelihood of high risk for depression as measured by the PHQ-2 (95% CI 1.013–1.040, $P<0.001$).

Results from this nationwide study provide the first evidence that increased non-clinical working hours also contribute to poorer patient outcomes. Fig. 1 illustrates these new findings, with a greater increase in IRR of medical errors for each additional non-clinical (as compared to clinical) hour worked. An exponential increase in medical error was demonstrated when both clinical and non-clinical hours increased. Longer non-clinical hours were shown to increase the likelihood for poor sleep and risk of depression, which could be mediators of this relationship.

While the mean clinical hours worked was less than 80 hours a week, most respondents would have exceeded this once non-clinical hours were added. Previous studies have reported widespread working hour violations⁵ and under-reporting⁶ of duties, further compounding the difficulties in assessing the impact of these additional working hours. We expanded the definition of non-clinical hours beyond just on-site educational hours defined by ACGME, also including administrative and mandated academic work.

Although the response rate was 26%, this is comparable to that of nationwide surveys in other populations,^{7,8} and our study represents the largest on the topic in Singapore. The qualitative interviews also provide context and rationale regarding possible reasons for non-response to the electronic survey.

During these semi-structured interviews, junior doctors reported their concerns in providing feedback on working conditions, for fear of “putting a target on their back” and compromising their opportunities for entering a residency training programme or for “fear of reprisal” that could threaten livelihoods, as most junior doctors are bonded to public healthcare system. Furthermore, some respondents felt that their feedback was neglected, citing that “they (public healthcare institutions) don’t seem to want to take into account what my feedback is”. It is important to recognise the barriers (fears, concerns and apathy) that would need to be addressed. While further efforts should be made to confirm this study’s findings, a non-anonymised methodology would be subject to the Hawthorne effect and results may prove unreliable.

It is evident from this new data that non-clinical working hours are an overlooked predictor of patient and physician outcomes, and residency programmes should be cognisant of the effect of these additional duties on junior doctor’s performance and patient safety.

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