

An efficient work schedule for medical interns at Chris Hani Baragwanath Academic Hospital

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KEYWORDS

Medical Interns/ Chris Hani Baragwanath Academic Hospital/ HPCSA/ long working hours/ extended shift work/ stress and burnout/ fatigue/ work schedule/ Generative Artificial Intelligence/ ChatGPT

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LIST OF ACRONYMS

ACGME- Accreditation Council for Graduate Medical Education

CHBAH- Chris Hani Baragwanath Academic Hospital

CSMO- Community service medical officers

Generative Artificial Intelligence- Generative AI

HIMS- Health Information Management System

HPCSA- Health Professionals Council of South Africa

HR- Human Resource

Interns- Medical Interns

MEU- Medical Emergency Unit

MO's- Medical Officers

MVA- Motor vehicle accident

SWH- Safe Working Hours

ABSTRACT

Medical internship is a period associated with a high risk of fatigue and burnout mainly due to long working hours, negatively impacting the interns' wellbeing, learning experience, and quality of patient care (Gunasingam et al., 2015). The Health Professionals Council of South Africa (HPCSA) serves as the regulatory body overseeing internship training and sets regulations for training institutions, such as Chris Hani Baragwanath Academic Hospital (CHBAH), to comply with.

The objective of this study is to develop an efficient work schedule for CHBAH interns compliant with HPCSA regulations, ultimately contributing to reduced burnout, enhanced intern well-being, improved learning experience and potentially improved patient care quality.

This study demonstrated that the working hours on the actual work schedules for CHBAH interns during the General Medicine, Obstetrics and Gynaecology, and General surgery rotations were indeed non-compliant with HPCSA regulations and that additional interns will be required during those rotations to ensure compliance.

To develop an efficient work schedule for CHBAH interns compliant with HPCSA regulations; ChatGPT 4.0, which is Generative Artificial Intelligence (AI), was used in this study and the model was initially trained to fully account for the HPCSA regulations. Following the training of ChatGPT 4.0, the ideal generic intern work schedule was created and coded, with the aim to develop an efficient intern schedule for CHBAH interns for each rotation, adhering to both the HPCSA regulations and the department's unique work structure.

By developing an efficient work schedule compliant with HPCSA regulations, interns at CHBAH will experience less risk of fatigue and burnout, and therefore enhanced intern well-being, improved learning experience and potentially improved patient care quality.

DEFINITIONS

- a) Burnout- It is described as an occupational stress and is defined as “chronic depletion of energy because of ongoing emotional demands associated with one’s occupation” (Ireland et al., 2017).
- b) Community service medical officers (CSMO)- Medical doctors who have completed their two-year internship program and now working their one-year compulsory community service.
- c) Consultants- Specialist medical doctors who have specialised in a particular specialty domain.
- d) Continuous/ Extended shift work- This is continuous hours worked during a shift, also known as a “call.” The 26-hour “call” as regulated by the HPCSA consists of a regular 8-hour normal day shift immediately followed by continuous 18-hours of working throughout the night (Maoz Breuer et al., 2023).
- e) Medical Officers (MOs)- Independent medical doctors who completed their one-year compulsory community service.
- f) Night floats- A scheduling system requiring temporary rotation to a 13-hour night shift schedule once or twice a month for few consecutive nights, leading to shorter call duration (Maoz Breuer et al., 2023).
- g) Overtime- Hours worked outside of the normal working hours and is capped at 20-hours per week and 80-hours per month for medical interns (HPCSA, 2023).
- h) Registrars- Medical doctors undergoing training in a specialty domain to become consultants.

CHAPTER 1. INTRODUCTION

1.1 Statement of purpose

This study addresses the challenge of long working hours among medical interns (interns). It considers a work schedule that adheres to the regulatory standards set by the Health Professions Council of South Africa (HPCSA) to mitigate the adverse effects linked to prolonged work hours.

1.2 Background of the study

Interns are newly qualified junior medical doctors undergoing a compulsory two-year internship training programme at an accredited training institution after completing medical school (Ross et al., 2018). Oversight of the internship training programme is regulated by the HPCSA which ensures adherence of accredited institutions to prescribed guidelines and requirements (HPCSA, 2023).

Chris Hani Baragwanath Academic Hospital (CHBAH) is the largest hospital in Southern Africa, located in Soweto township, and is one of the HPCSA accredited medical intern training institutions. It is regarded as the busiest and most demanding training institution due to its high patient load (Essa, 2010). Essa (2010) analysed post-internship experiences in three Johannesburg internship training institutions; namely, CHBAH, Charlotte Maxeke Johannesburg Academic Hospital, and Helen Joseph/Rahima Moosa Mother and Child Hospital complex, and found that the interns at CHBAH experienced more stress than those at the other two hospitals (Essa, 2010). However, CHBAH is also known as a place where interns acquire rich medical training experience to develop into highly competent independent medical doctors (Essa, 2010).

The internship training programme requires the intern to rotate across four different specialty domains comprising of three-months stints in General medicine, General surgery, Paediatrics, and Obstetrics and Gynaecology during the first year of training. The second year requires two-months rotations across Anaesthesiology, Orthopaedics, Psychiatry, and six-months for Family Medicine

(HPCSA, 2023). This structured programme is intended to train the intern under supervision of a qualified medical doctor across the various medical disciplines and equip them with the necessary skills to work independently during their one-year compulsory community service training that follows internship training.

The medical doctor organizational structure is hierarchal with interns at the bottom of the hierarchy. These junior doctors provide patients with first point of care, following handover from the nursing staff, and are therefore an essential component of the medical team. However, the radical transition that interns experience from being a student, to taking on the massive responsibility of human life in resource constrained and highly demanding work environments can be very overwhelming for the interns and lead to burnout (Essa, 2010).

One such example is the requirement from HPCSA for interns to work overtime as part of service delivery and training (HPCSA, 2023). Prior to 2017, HPCSA recommended a maximum 60-hour work week and capped extended/continuous shift work at 30-hours (Ross et al., 2018). However, in 2014, a campaign initiated by medical students and interns called Safe Working Hours (SWH), aimed at generating “an evidence-based discussion” around intern working hours was advocating for a reduction of extended shift work to 16-hours (Kotze et al., 2020). The request for 16-hours was backed by “evidence that shifts longer than 16-hours are associated with increased risk of harm for both the intern and patient due to fatigue, which leads to cognitive impairment and poor decision-making, as well as an increased risk of motor vehicle accidents (MVA) and needle-stick injuries” (van der Westhuizen, 2014). This campaign gathered momentum with an online petition and required involvement of various stakeholders such as Junior Doctor Association of South Africa which is part of South African Medical Association, HPCSA, Department of Health, and SWH representatives to review the regulations on intern work hours (Kotze et al., 2020).

Following a MVA fatality by a medical doctor after a 30-hour extended shift in 2017, the HPCSA reviewed their guidelines and recommended that interns be limited to maximum of 26-hour extended shift work (Ross, 2018) (Kotze et al., 2020) with “shorter shifts preferred” according to HPCSA (2023).

However, compliance to the intern working hours regulations remains a challenge due to staff shortages, high patient load, and limited assistance from nursing colleagues (Bola et al., 2015), as well as no formal monitoring processes in place to determine the hours worked by the intern. According to the Occupational Health and Safety Act (1993), the employer has the responsibility to provide as far as reasonably practicable, a safe workplace without risk to the health and safety of the employee. In turn, the employee has the right to refuse to work in a workplace in which they feel their health and safety is at risk (Occupational Health and Safety Act, 1993). However, the latter is not practical given that interns are not normally aware of their employment rights or fear victimisation if they spoke up which could potentially impact completion of their internship training. It is therefore imperative to develop an effective system that protects this vulnerable group of medical doctors from being a danger to self, patients, and society.

1.3 Research problem

Interns are subjected to long working hours which has negative consequences on their health and well-being, learning experience, and on the quality of care provided to patients.

1.4 Research objective

To develop an intern work schedule which adheres to HPCSA regulatory standards on working hours that will contribute to reduced burnout, enhanced intern well-being, improved learning experience and potentially improved patient care quality at CHBAH.

1.5 Rationale

The research offers insights for enhancing the working conditions of interns at CHBAH. By extrapolating data from CHBAH, the study will devise a work schedule that aligns with the regulatory environment and optimises the intern well-being, learning experience, and patient care.

1.6 Delimitations and limitations of the study

The delimitations of the study are related to its focus on internship training at CHBAH. The limitations relate to the availability of the required data to undertake the study.

1.7 Assumptions

The research is dependent on the data captured in the CHBAH Health Information Management System (HIMS) and Human Resource (HR) database being accurate and available to undertake the study.

The research also assumes that the HPCSA regulations are structured to ensure optimal intern wellbeing, learning experience, as well as ensuring quality patient care is provided by the intern.

1.8 Chapter Outline

Medical internship training is a demanding two-year programme aimed to equip the junior doctor with adequate skills to work as an independent medical doctor. These junior doctors are at the bottom of the hierarchy in the organisational structure and are at high risk of experiencing occupational stress and burnout. The risk of occupational stress at CHBAH is said to be high due to the heavy patient load (Essa, 2010), and this can be a reflection of the CHBAH organisational culture to provide the intern with “rich medical training experience to develop into highly competent independent medical doctors” (Essa, 2010). The internship training is fortunately regulated by the HPCSA to ensure the intern is adequately trained at training institutions compliant to their guidelines and regulations. However, compliance with the HPCSA regulations on working hours is not always adhered to (Bola et al., 2015), resulting in negative outcomes for the intern and patients.

This study analyses data from CHBAH, to devise a work schedule for interns which adheres to HPCSA regulatory standards and will contribute to reduced

burnout, enhanced intern well-being, improved learning experience and potentially improved patient care quality at CHBAH.

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

Stress and burnout are prevalent among interns (Gunasingam et al., 2015). Burnout, described as an occupational stress, is defined as “chronic depletion of energy because of ongoing emotional demands associated with one’s occupation” (Ireland et al., 2017) and is a devastating consequence of the demanding work conditions interns are subjected to (Essa, 2010). Long working hours is one of the contributing factors of stress and burnout among interns (Gunasingam et al., 2015) (Ireland et al., 2017), of which the consequences have personal and organizational ramifications. At a personal level, burnout leads to lack of humanity towards the patient (Essa, 2010), low career satisfaction (Ireland et al., 2017), personal health neglect, and increased risk of occupational injuries and MVA (Gunasingam et al., 2015). Consequences at an organisational level include medical errors, suboptimal patient care, increased risk of being sued for malpractice, increased rate of absenteeism, and reduced productivity (Ireland et al., 2017).

Numerous stress reduction and burnout prevention interventions have been researched and proposed as part of the medical internship programme. However, interventions requiring implementation of intern work hour limits to reduce prevalence of burnout have conflicting opinions (Gunasingam et al., 2015).

There are several workload management theories that could play a role in reducing burnout among medical interns. The literature review by Parasuraman R, et al. (2005) explores these theories and proposes enhancements to workload modelling and management strategies (Parasuraman & Rovira, 2005). These theoretical insights can be applied to the scheduling and workload management of medical interns in hospital settings. Firstly, the Cross-modal links in spatial attention theory, highlights the interconnectedness of different sensory modalities and their collective impact on attention and workload (Parasuraman & Rovira, 2005). Cross-modal attention training can be provided to interns to enhance their

ability to manage information from various sources, thus improving multitasking capabilities.

The Malleable attentional resource theory is the second theory explored by Parasuraman R, et al. (2005) and it suggests that attentional resources are flexible and can be reallocated based on task demands, thus allowing for dynamic workload management (Parasuraman & Rovira, 2005). This theory can be applied in designing schedules that allow interns to switch between tasks requiring different levels of attention to prevent cognitive fatigue.

Another theory is the Dynamic workload modelling theory, which advocates for real-time assessment and adjustment of workload, recognizing that task demands and individual capacities fluctuate over time (Parasuraman & Rovira, 2005). The application of this theory may require implementation of real-time monitoring systems to assess interns' workload, thus allowing for immediate adjustments to prevent burnout.

The fourth theory reviewed by Parasuraman R, et al. (2005) is the Task Prioritization theory which emphasizes ranking tasks based on urgency and importance to effectively manage workload (Parasuraman & Rovira, 2005). Interns can be trained in task prioritization to enable them to effectively distinguish between urgent and non-urgent tasks, thus optimizing their workflow.

Latent performance decrements theory is the fifth theory which addresses the subtle declines in performance that may not be immediately apparent but can accumulate over time due to sustained workload (Parasuraman & Rovira, 2005). Monitoring of latent performance decrements can be achieved by establishing regular follow-up appointments with the interns to detect subtle declines in performance and therefore enabling timely interventions to prevent burnout.

And lastly, the Incorporation of theoretical models into scheduling tools strategy can be applied through the use of an advanced scheduling software that integrates these theoretical models to effectively manage interns' workload (Parasuraman & Rovira, 2005).

For the purpose of this study, no significant workload and scheduling management theory is relied upon. Instead, The HPCSA regulations were used as the gold standard in ensuring workload management among medical interns.

2.1.1 *National versus international regulations on intern working hours.*

Regulations around intern working hours is a contested and controversial issue worldwide. HPCSA last reviewed their guidelines in 2017 and recommended that interns be limited to working 60-hours per week, and reduced the extended shift working hours from 30-hours to a maximum of 26-hours (HPCSA, 2023).

In the United States, interns are regulated by the Accreditation Council for Graduate Medical Education (ACGME) which has changed the structure of medical training over the years because of patient safety concerns resulting from intern extended shift work and fatigue (Weiss, 2016). In 2003, the ACGME mandated maximum 80-hour work week and limit of 30-hours extended shift work, and in 2011 the requirements remained 80-hour work week but the extended shift working hours were significantly reduced to 16-hours (Weiss, 2016).

Regulations in European countries vary regarding maximum weekly working hours and extended shift work. Maximum weekly working hours are 80-hours in Canada; 48-hours in England, Finland, Hungary, Ireland, Netherlands, Slovenia, and Spain; 42-hours in Germany; and 40-hours in Czech Republic, Estonia, and Latvia (Maoz Breuer et al., 2023). Maximum extended shift duration of 26-hours is mandated in Canada; 24-hours for Estonia, Finland, Germany, Ireland, Latvia, Netherlands, and Spain; 16-hours for Czech Republic, Hungary, and Slovenia; and England has the least with 13-hours (Maoz Breuer et al., 2023).

2.1.2 *Sleep physiology and consequences of long working hours.*

A study by Lockley et al. (2006) reviewed the physiological sleep principles underlying fatigue, as well as the impact of extended shift work on interns' health and patient safety. The physiological principles explain the unrealistic expectations of interns to maintain continuous wakefulness and alertness during

the night, which increases their risk of work-related accidents and fatigue-related errors (Lockley et al., 2006).

Consequences of extended shift work are fatigue, chronic sleep deprivation (Weiss et al., 2016), impaired decision making (Ross et al., 2018), increased risk of needlestick injuries and MVA (Lockley et al., 2006) (Weiss et al., 2016), negative mood changes such as depression and burnout (Weiss et al., 2016), as well as negative impact on patient care (Landrigan et al., 2004) and on medical interns quality of life (Maoz Breuer et al., 2023). The health effects of long working hours are an increased risk of diabetes, obesity, cardiovascular diseases (Grandner, 2022), increased cancer risk, compromised immune system (James et al., 2017), cerebrovascular diseases, and negative health behaviours such as smoking, alcohol abuse, and physical inactivity (Wong et al., 2019).

Understanding sleep physiology is therefore pertinent in developing sound evidence-based policies (Lockley et al., 2006) to reduce the negative outcomes of long working hours on the interns' wellbeing and patient care.

2.1.3 *Strategies to reduce intern working hours*

A comparative analysis study by Maoz Breuer et al., (2023) reviewed five strategies implemented in different countries to reduce residents' work burden caused by long working hours. These five strategies include shorter shift length, limited weekly working hours, limited monthly night shifts, night floats, and rest breaks (Maoz Breuer et al., 2023).

- Shorter shift lengths less than 16-hours is associated with improved attentiveness during the night shift, less risk of medical errors (Lockley et al., 2006), as well as reduced burnout and job satisfaction (Weiss et al., 2016). Therefore, reducing the extended working hours of interns is ultimately what makes sense as a step in the right direction, however, it could lead to unintended consequences. Reducing shifts to less than 16 hours without additional workforce will unfortunately increase the labour

cost as interns are an inexpensive labour source (Lockley et al., 2006), have negative impact on intern education (Lockley et al., 2006), increase numbers of night and weekend calls, as well as increase patient workload and patient handover which could lead to medical errors (Maoz Breuer et al., 2023). A solution could be for addition of non-clinical health workers to the workforce to relieve interns of unnecessary tasks not beneficial to intern training, thus reducing their workload (Maoz Breuer et al., 2023). These may include phlebotomy services, hospital assistants that could relieve nursing staff from non-medical tasks to increase the nursing staff capacity to assist interns, ward clerks to search for patient results, as well as having a co-ordinator to arrange patient discharge (Bola et al., 2015).

- Working more than a 40-hour work week is associated with increased fatigue and negative impact on employee's performance and job satisfaction (Dall'Ora et al., 2016). The study by Maoz Breuer et al., (2023) showed poor compliance to weekly working hours in European countries due to staff shortages and many of these countries introduced opt-out mechanisms to allow residents to voluntarily work above the regulated hours for extra compensation. However, policies that allow for voluntary paid work beyond regulated hours are not ideal as this increases risk of medical errors (Dall'Ora et al., 2016).
- Night floats were successfully implemented in England, but problematic in many countries. They are associated with less sleep and increased fatigue; leading to negative impact on education, as well as mental and physical health (Maoz Breuer et al., 2023) (Weiss et al., 2016).
- Rest breaks are an effective strategy as they allow for "protected sleep through strategic naps during an extended shift, leading to improved attention and cognitive functioning (Weiss et al., 2016)".

2.2 Definition of topic or background discussion

An interventional trial by Landrigan et al. (2004) to eliminate extended shift work to 16-hours and reduce weekly working hours to 60-hours showed success in reducing medical errors by interns in an Intensive Care Unit (ICU) setting. This intervention schedule divided the intern work schedules into 16-hour "day-call"

(7am-9pm) covered by one intern and another intern covering the 16-hour “night-call” (9pm-1pm) the following day. This study revealed a positive impact on sleep physiology, however, shortfalls with any intervention schedule aimed to reduce work hours may lead to an increase in patient workload or in an increased number of patients handed over from one shift to the next; which can inadvertently lead to increased medical errors (Landrigan et al., 2004). Therefore workload, and not only number of interns, should be factored in when developing interventions to reduce working hours (Maoz Breuer et al., 2023).

Shortfalls with this interventional trial was the education gap for interns working in the night, and suggestions to have formal evening ward rounds for the entire team was recommended (Landrigan et al., 2004). Interventions incorporating technology can also be used to support handover processes (Maoz Breuer et al., 2023). Another shortfall was the poor ability to monitor hours worked by the interns due to poor compliance in using the computerized sign-out process (Landrigan et al., 2004). It is therefore imperative that there are effective mechanisms in place to monitor and enforce directives on working hour limits to have successful implementation of the intervention schedules aimed to reduce working hours (Maoz Breuer et al., 2023).

2.3 Research objective and hypothesis

2.3.1 *Research objective*

To develop an intern work schedule which adheres to HPCSA regulatory standards on working hours that will contribute to reduced burnout, enhanced intern well-being, improved learning experience and potentially improved patient care quality at CHBAH.

2.3.2 *Hypothesis*

Implementing a work schedule at CHBAH, which adheres to HPCSA regulatory standards on working hours, will lead to reduced working hours for interns which

will contribute to reduced burnout, improved intern well-being, improved learning experience and potentially enhanced patient care quality.

2.4 Conclusion of Literature Review

Long working hours are a contributing factor to the high levels of stress and burnout during medical internship training in South Africa (Essa, 2010). HPCSA regulations on intern working hours varies from other countries internationally, as well as literature recommendations. Addressing those discrepancies requires understanding of sleep physiology to develop sound policies (Lockley et al., 2006). Many strategies to reduce intern working hours are associated with positive outcomes, however it could also have unintended negative consequences (Landrigan, 2004). It is therefore imperative that development of any intervention schedules aimed at reducing working hours not only rely on number of interns but considers workload, and effective monitoring processes need to exist to ensure compliance to the intervention schedules (Maoz Breuer et al., 2023).

CHAPTER 3. RESEARCH METHODOLOGY

3.1 Research approach

The methodology involves a quantitative approach using numeric data available in the CHBAH Health Information Management System (HIMS) and Human Resource (HR) database, as well as an analysis of current intern work schedules from the specialty domains. The study uses data from HR department regarding the number of interns and qualified doctors in various speciality domains, as well as data from HIMS regarding the number of patients treated over the past three years in various speciality domains. Some of this data was used to:

- Develop a generic ideal work schedule for interns that complies with HPCSA regulations using Generative Artificial Intelligence (AI).
- Analyse the current intern work schedule across the various specialty domains and evaluate how it relates to HPCSA regulatory requirements.
- Estimate the number of interns needed to meet the demand within the specialty domains at CHBAH.
- Develop an efficient work schedule for the CHBAH interns across various specialty domains.

3.2 Research design

An exploratory case study of CHBAH informs the research design through secondary data collection. CHBAH was selected because it is the largest and busiest hospital in South Africa and could provide a good indication of the problems and complexities associated with internship accredited institutions. The site is also convenient in terms of time and resources as it is the researcher's workplace.

3.3 Data collection methods

The following data was requested from CHBAH HR and HIMS database over the past three years:

- The number of interns allocated to CHBAH.
- The number of interns, community service doctors (CSMO's), medical officers (MO's), registrars, and consultants across the speciality domains.
- The number of patients treated across the speciality domains.

The monthly intern work schedules were requested from secretaries across various specialty domains.

3.4 Population and sampling method

CHBAH will be the case site for the research. The required data is already available on the CHBAH HIMS, HR database, and from the departments within which interns rotate. The study is thus not reliant on primary data.

3.5 The research instrument

Generative Artificial Intelligence (AI) was used as a research instrument to devise a work schedule for interns that is compliant with HPCSA requirements. Generative AI is increasingly used to devise programmes to address certain problems in industries such as healthcare, construction, education, and human resource (Prieto et al.,2023) (Ratnam et al., 2023). In this study, ChatGPT 4.0 was used to devise a work schedule for interns.

ChatGPT is a general purpose discussion chatbot that was published by OpenAI on 30 November 2022 (Ratnam et al., 2023). ChatGPT differs from long existing Natural Language Processing techniques such as GPT models because it is trained for conversation and not only for single-prompt use (Prieto et al., 2023). Advantages of Generative AI is speed, accuracy, efficiency, multitasking, and fact based decision-making (Khanzode & Sarode, 2020). Due to its conversational

properties; ChatGPT can allow the user to correct it when it makes a mistake, and it can also explain its response (Amos, 2022).

The use of Generative AI as a research instrument for this study follows the work of Prieto et al. (2023) who used ChatGPT for project scheduling and task assignment in a small construction project (Prieto et al., 2023). The initial input required enough details of the scope of work, followed by prompts to challenge ChatGPT (Prieto et al., 2023). Figure 1 highlights the steps followed in the study by Prieto et al. (2023).

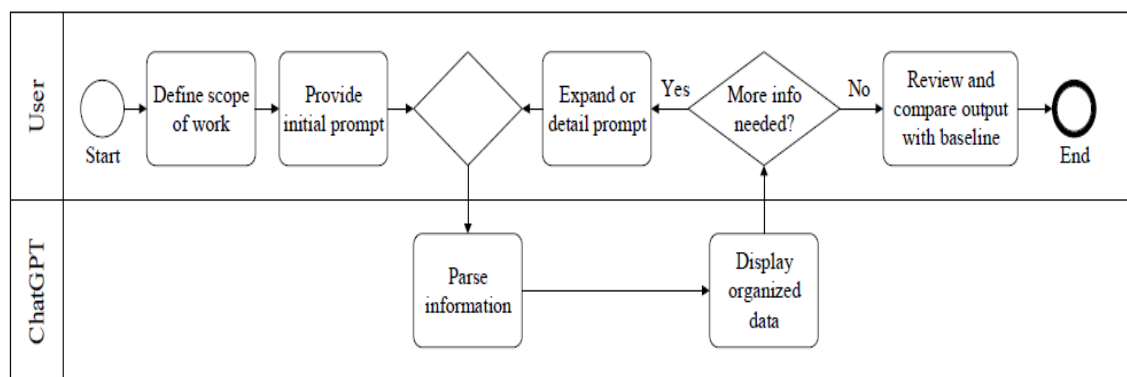


Figure 1: Overview of the main steps for using and assessing ChatGPT (Prieto et al., 2023)

3.6 Procedure for data collection

Data from CHBAH HIMS and HR database was provided after ethics clearance. ChatGPT was used to undertake the estimates and develop an ideal generic work schedule for CHBAH interns that is compliant to HPCSA regulations. Thereafter, the actual work schedules were requested from the various specialty domains for the month of November 2024 and assessed for compliance with HPCSA regulations.

3.7 Data analysis strategies and interpretation

Following the methodology by Prieto et al. (2023), the next steps were utilized to analyse data and to devise an ideal generic work schedule for CHBAH interns:

Step one: ChatGPT 4.0 was provided documents and trained to take account of all the HPCSA requirements on intern training as well as training on the general South African Labour laws.

Step two: ChatGPT was given a first prompt to provide conditions from the regulations which are essential for intern training.

Step three: ChatGPT was given a second prompt to use the conditions provided to create an ideal generic schedule for interns that conforms to regulations.

Step four: ChatGPT was given a prompt to write an Excel code to generate the ideal generic work schedule.

Following the creation of an ideal generic work schedule using ChatGPT, the actual work schedules from the top five busiest specialty domains for the month of November 2024 were evaluated using Excel to assess whether the departments are compliant to the conditions regulated by HPCSA with regards to working hours, overtime and patient workload.

An estimate on the excess number of hours worked was calculated to provide an indication of how many interns should be allocated to CHBAH.

The estimates will be reviewed, and further prompts considering the number of interns, and work structures of the various specialty domains will need to be given to ChatGPT to refine the ideal generic work schedule coded. This will result in the development of a programme in Excel which could be used to develop work schedules for interns aligned with the HPCSA regulatory requirements as well as the department work structure.

3.8 Limitations

ChatGPT relies on the details provided, and results generated must be reviewed for accuracy (Prieto, 2023). ChatGPT can also be overconfident with its incorrect response and may not allow the user to correct it (Amos, 2022). These ChatGPT limitations were addressed through manual verification of the responses. Another ChatGPT limitation is that the responses generated are influenced by the framing

of questions and prompts given; therefore, minor changes may lead to contradicting responses (Amos, 2022). This issue was mitigated by thorough training of the model to ensure consistency.

The study encountered limitations related to HIMS, whereby some data was manually collected, and some was from the electronic system. This introduced potential human error that could not be verified by the researcher due to confidentiality constraints. Another limitation from the HIMS is that there was no available data on the number of patients seen in the anaesthesiology department. This was mitigated by using a proxy calculation based on patients seen in the four main theatres with the assumption that an anaesthetist would have been present and seen the patients. However, this approach excluded other theatres.

The actual work schedules provided by various departments included doctors' names and contact details. This data was maintained confidential and anonymized by assigning numerical labels, such as Intern 1, 2, etc. Another limitation regarding the work schedules was that only the month of November 2024 was analysed, which might not be a true reflection of intern allocation and call frequency data across the year in the various departments.

3.9 Quality Assurance

To evaluate the results from ChatGPT, Prieto et al. (2023) used the following parameters, which were also adopted for this study:

1. Accuracy- "comparison of the schedule generated by ChatGPT against that created by a human project manager" (Prieto et al., 2023). In this study the results were evaluated against the currently existing work schedule in various specialty domains.
2. Consistency- "measured by evaluating whether the responses from ChatGPT are constant by making slight modifications to the initial prompt multiple times" (Prieto et al., 2023).

3. Reliability- “evaluated by ensuring that results conform with the regulatory standards, and whether the results were adequate if they had to be used in a real project” (Prieto et al., 2023).
4. Relevance- “the response from ChatGPT must be relevant to the input prompt and not deviate from the original tasks defined in the scope of work” (Prieto et al., 2023).

3.10 Ethical considerations

The study relied on a retrospective ethics application given and relies on secondary data.

CHAPTER 4. FINDINGS AND ANALYSIS

4.1 Data Collection

Data was collected from the HR and HIMS departments at CHBAH, and the intern work schedules were obtained from the various specialty domains.

4.1.1 *Human Resource (HR) Department:*

Data pertaining to the number of doctors in the years 2021-2023 was sourced from the HR database as illustrated in Table 1. However, with regards to interns, the database only provided the total number employed and not a specific breakdown as to the allocations in the various specialty domains. This information regarding the allocations was requested from the CHBAH medical intern curator and co-ordinator, and clarity was also provided by the Family Medicine intern curator.

	2021	2022	2023
Total number of medical interns allocated to CHBAH:	255	311	321
Total number of CSMOs allocated to CHBAH:	9	10	14
Number of medical Drs in different specialty domains:			
General Medicine (Internal Medicine)	91	91	90
Medical officers (MO's)	18	18	17
Registrars	43	43	43
Consultants	30	30	30
General Surgery	48	47	47
Medical officers (MO's)	12	11	11
Registrars	17	18	18
Consultants	19	18	18
Paediatrics	104	107	107
Medical officers (MO's)	21	23	24
Registrars	44	45	45
Consultants	39	39	38
Obstetrics and Gynaecology	67	67	67
Medical officers (MO's)	24	22	22
Registrars	27	27	27
Consultants	16	18	18
Anaesthesiology	86	93	160
Medical officers (MO's)	14	22	44
Registrars	43	43	70
Consultants	29	28	46
Orthopaedics	56	56	56
Medical officers (MO's)	14	14	14
Registrars	26	26	26
Consultants	16	16	16
Psychiatry	33	33	33
Medical officers (MO's)	10	10	10
Registrars	14	14	14
Consultants	9	9	9
Family Medicine: Emergency Medicine (MEU)	28	29	48
Medical officers (MO's)	21	21	26
Registrars	4	4	18
Consultants	3	4	4

Table 1: Data collected from HR regarding number of Doctors at CHBAH from 2021-2023

INTERN AND CSMO ALLOCATIONS

Every year CHBAH is allocated approximately 120 interns in January and the numbers may increase during the year due to asynchronous interns who may begin internship either during the April, July, or October intakes. The intern numbers may also fluctuate with some resigning, illness, maternity leave, and others failing and having to repeat a rotation.

The allocation of first year interns is evenly split between the four rotations namely, General/Internal Medicine, General Surgery, Obstetrics and Gynaecology, and Paediatrics. During the second year of internship training, the interns are equally divided into two groups (Group 1 and Group 2). Group 1 is allocated to Family

Medicine and the interns in group 2 are evenly distributed among Anaesthesiology, Orthopaedics and Psychiatry rotations.

The Family Medicine rotation is not run from CHBAH, but forms part of the Johannesburg Health District. CHBAH interns are allocated to two of the seven Subdistricts; namely Subdistrict D which is Soweto, and subdistrict G which is Lenasia and Stretford areas. During the 6-month Family Medicine rotation; interns rotate 1-month in Emergency Medicine either at CHBAH Medical Emergency Unit (MEU) or Bheki Mlangeni District hospital, and another 1-month at a District hospital either Bheki Mlangeni or Lenasia South where interns work in Medical, Paediatrics, and Obstetrics and Gynaecology wards. The interns also spend 2-weeks in Community Oriented Primary Care (COPC), and 3,5-months at Community Healthcare Centres Outpatient Departments (OPD) and Emergency Departments in Subdistrict D (Lillian Ngoyi, Mofolo, Itireleng, and Chiawelo) as well as Subdistrict G (Stretford, and Lenasia Extension 13). The number of interns allocated to the Family Medicine rotation in 2021, 2022, and 2023 are sixty-six, sixty, and eighty-six, respectively. However, during the 1-month Emergency Medicine rotation at CHBAH MEU approximately 5 - 7 interns were allocated during 2021 and 2022, and 7-10 interns in 2023.

Information regarding allocation of Community Service Medical Officers (CSMOs) in various specialty domains was also not obtained from the HR database, but from the intern co-ordinator. The number of CSMOs received yearly by CHBAH is evenly allocated to General Medicine, General Surgery, Paediatrics, and Obstetrics and Gynaecology departments as illustrated in Table 2.

Medical Intern Allocation	2021	2022	2023
Internal Medicine	30	43	40
Surgery	30	43	40
Paediatrics	30	43	40
Obstetrics and Gynaecology	30	43	40
Anaesthetics	22	20	29
Orthopaedics	22	20	29
Psychiatry	22	20	29
Family Medicine	66	60	86
Total	252	292	333

CSMO	2021	2022	2023
Internal Medicine	2	2	2
Surgery	2	2	2
Paediatrics	2	2	2
Obstetrics and Gynaecology	2	2	2
Total	8	8	8

Table 2: Medical Interns and CSMOs allocations in years 2021-2023

A discrepancy was noted between the total numbers of interns and CSMOs reported in the HR database and those provided by the Intern co-ordinator, whose main responsibility is to allocate the interns and CSMOs to the various specialty domains. This could be explained by the fluctuations of numbers throughout the year as previously explained. However, for the purpose of this study, data provided by the Intern co-ordinator was utilised.

4.1.2 Health Information Management Systems (HIMS) Department:

Information regarding patients seen or admitted in the various specialty domains was obtained from the HIMS database at CHBAH as illustrated in Table 3. Further breakdown of the Obstetrics and Gynaecology department was provided as illustrated in Table 4. However, there was no information regarding patient count from the Anaesthesiology department as patients seen by anaesthetists are admitted by other departments such as General Surgery, and Obstetrics and Gynaecology. The Anaesthesiology patient count data was manually compiled by the data manager, who recorded the number of surgeries performed in the four main theatres at CHBAH: JD Allen, Obstetrics, Gynaecology, and Neonatal theatres from 2021-2023. The total number obtained was used as a proxy calculation for the Anaesthesiology department patient count as illustrated in Table 5. This is a limitation as it is an assumption, which is likely, that for all the theatre cases, an anaesthetist would be present and would have seen the patient. Another limitation is that only four main theatres were recorded, thus excluding other theatres.

For the Family Medicine rotation, the patient count from the Emergency Department Medical Emergency Unit (MEU) was collected. Interns rotate in this unit only during the Family Medicine rotation and do not rotate through the Trauma Emergency Unit or the Surgical Emergency Unit, which are also part of the Emergency Department.

	2021	2022	2023
Number of patients seen at/admitted at:			
General Medicine	19196	26841	26304
General Surgery	17363	18925	19238
Paediatrics	8665	12571	13466
Obstetrics and Gynaecology	25991	26432	25494
Anaesthesiology	79732	83006	74060
Orthopaedics	1526	1035	1294
Psychiatry	834	1387	1656
Family Medicine (Medical Emergency Unit)	23079	28019	27018

Table 3: Number of patients seen/admitted in various specialty domains during 2021-2023.

GYNAECOLOGY				
Period	Inpatient death	Inpatient discharge	Inpatient transfer out	Admission
2021	105	4187	4	4296
2022	145	4609	7	4761
2023	133	5039	7	5179
OBSTETRICS				
Period	Inpatient death	Inpatient discharge	Inpatient transfer out	Admission
2021	46	21617	32	21695
2022	30	21639	2	21671
2023	15	20287	13	20315

Table 4: Obstetrics and Gynaecology patient admission data

SURGICAL PROCEDURES CONDUCTED FROM 1 JANUARY TO 31 DECEMBER 2021-2023					
Period	JD Allen Theatre Cases	Maternity Theatre Cases	Gynae Theatre Cases	Neonatal Theatre Cases	Total
2021	69285	7632	2272	543	79732
2022	71068	8358	2683	897	83006
2023	62533	8116	2593	818	74060

Table 5: Number of theatre cases from 2021-2023 as a proxy calculation for Anaesthesiology department

4.1.3 Intern work schedules

The study evaluates the November 2024 intern work schedules from five specialty domains, namely: General Medicine, Obstetrics and Gynaecology, and General

Surgery which are first year rotations, as well as from Anaesthesiology, and Family Medicine which are second year rotations. Clarity on each of the departments' work structure was provided by Head of Departments and the departments' Intern curators.

4.2 Analysis

4.2.1 *Ideal generic work schedule for medical interns*

ChatGPT 4.0 was used to create an ideal generic work schedule for interns which complies with HPCSA regulations. The HPCSA 2024 handbook for medical interns, and the CCMA information sheet based on the Labour Relations Act were attached with an Initial Prompt 1, requesting ChatGPT to extrapolate working conditions which interns are subjected to during the internship training, as illustrated in Figure 2.



Figure 2: Initial Prompt 1

To assess whether the feedback was reliable, relevant, and consistent as described by Prieto et al. (2023), a separate chat with Initial Prompt 2 was provided to ChatGPT 4.0. Initial Prompt 2 was a slightly modified version of Initial Prompt 1, and the feedback was satisfactory as the response regarding the intern conditions matched those provided in Initial Prompt 1 as illustrated in Figure 3.

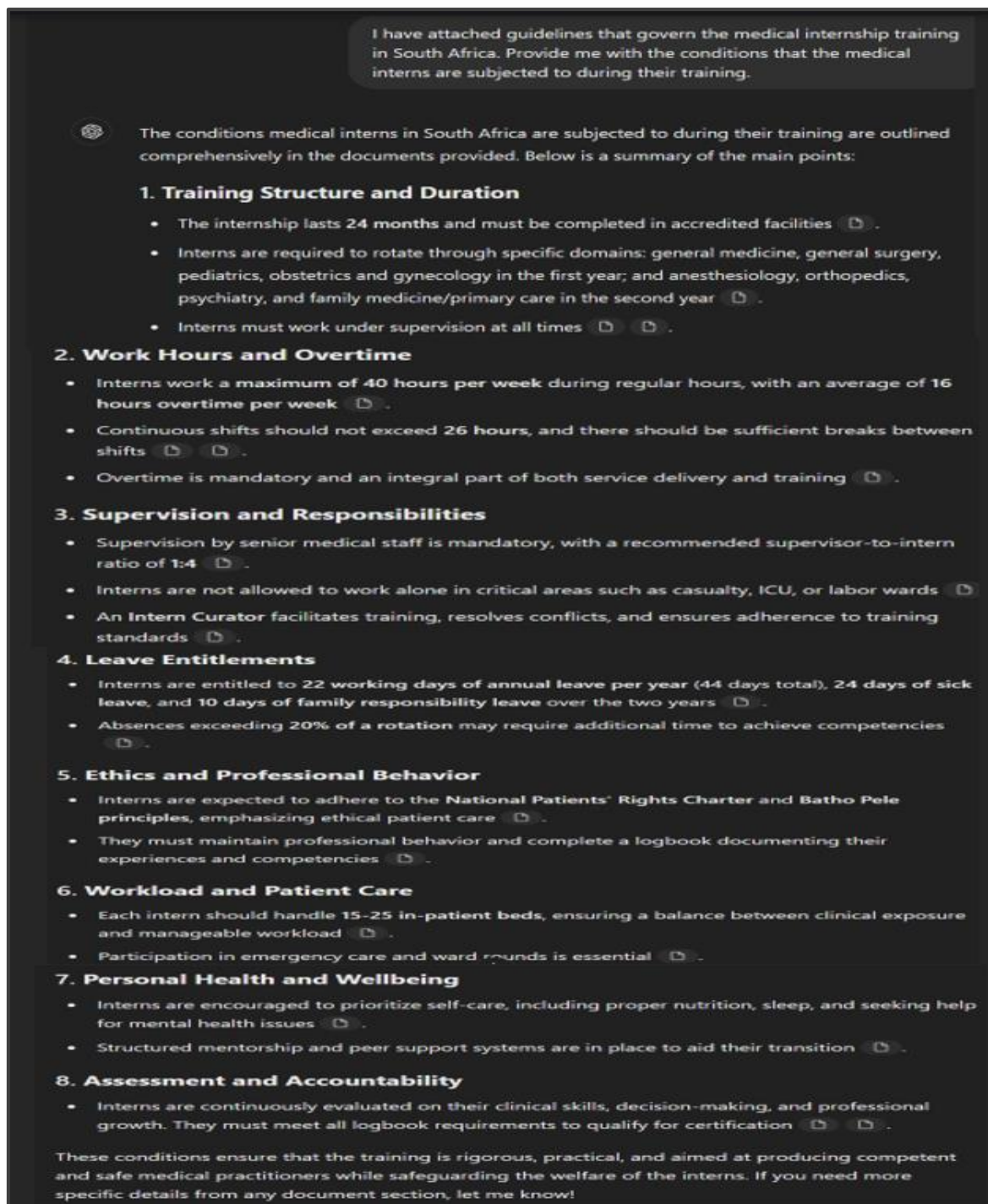


Figure 3: Initial Prompt 2

The conditions obtained from both Initial Prompt 1 and Initial Prompt 2 were refined and were noted as condition 1 of 4, as illustrated in Figure 4.

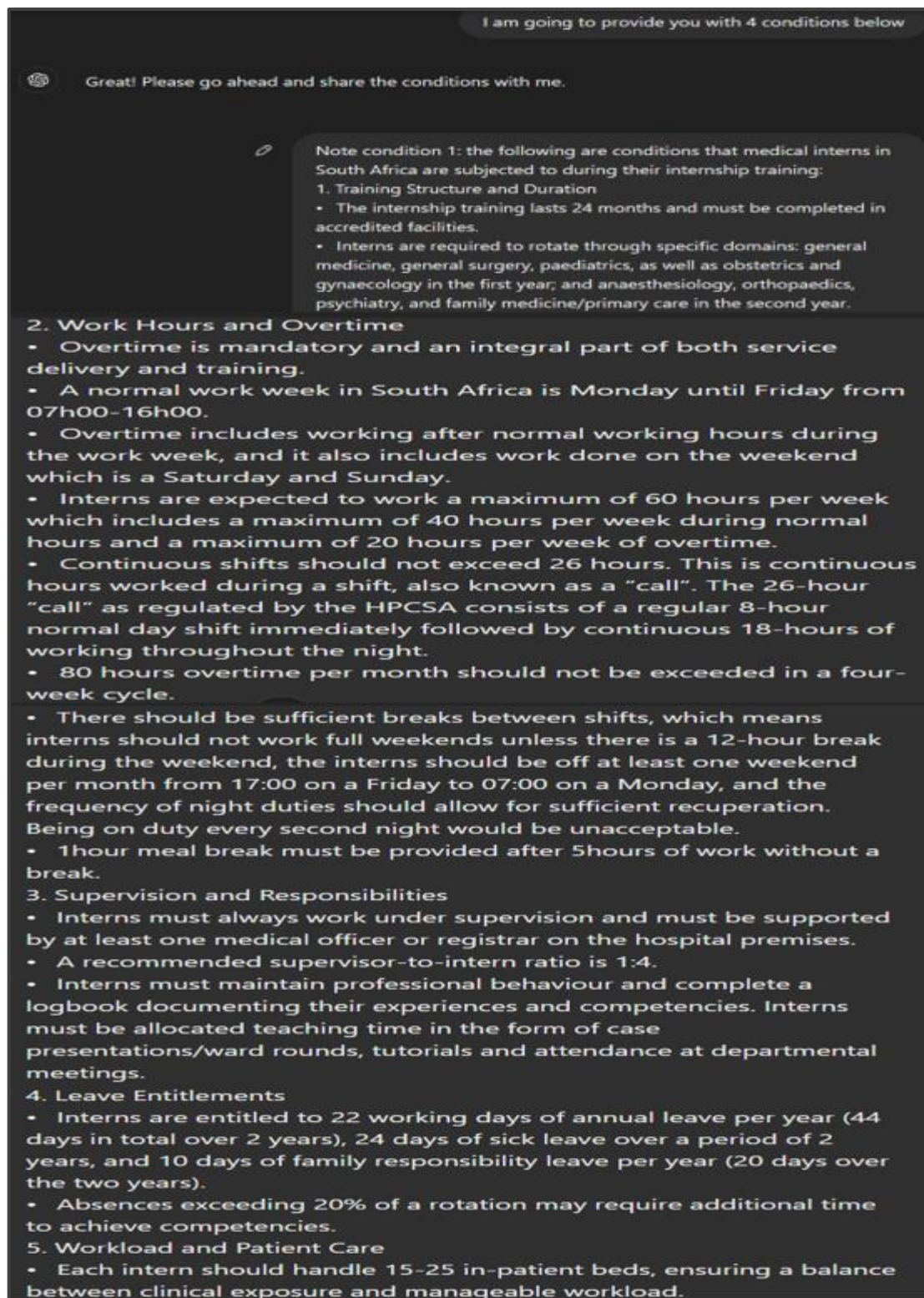


Figure 4: Condition 1 of 4

Condition 2 of 4, illustrated in Figure 5, provided an estimate of the number of patients an intern can see in an hour. This estimate varied for each rotation and

relied on the researchers' experience on the number of patients an intern can ideally see during a call.

Note further condition 2: During the rotations in the different domains, interns are only able to see a certain number of patients in an hour:

1. General Medicine- The intern can only see 2 patients in an hour.
2. General Surgery- The intern can only see 2 patients in an hour.
3. Paediatrics- The intern can only see 2 patients in an hour.
4. Obstetrics and Gynaecology- The intern can only see 4 patients in an hour.
5. Anaesthesiology- The intern can only see 1 patient in an hour
6. Orthopaedics- The intern can only see 3 patients in an hour.
7. Psychiatry- The intern can only see 1 patient in an hour.
8. Family medicine in the Emergency Department- The intern can only see 4 patients in an hour.

Figure 5: Condition 2 of 4

Condition 3 of 4 provided the first year internship rotations along with the duration as illustrated in Figure 6.

Further note condition 3: In year 1 of medical internship, interns rotate through the following four specialty domains, each lasting three (3) months:

1. General Medicine
2. General Surgery
3. Paediatrics
4. Obstetrics and Gynaecology

Figure 6: Condition 3 of 4

Condition 4 of 4 stipulated the second-year internship rotations with the duration as demonstrated in Figure 7 below.

Further note condition 4: In year 2 of medical internship, interns rotate through the following four specialty domains:

1. Anaesthesiology- 2months
2. Orthopaedics- 2months
3. Psychiatry- 2months
4. Family medicine in the Emergency Department- 6months

Figure 7: Condition 4 of 4

ChatGPT 4.0 was provided with a prompt to consider conditions 1- 4 and develop a work schedule for interns that conforms to the four conditions. Figure 8 illustrates the initial generic work schedule created.

Year 1 and Year 2 Work Schedule for Medical Interns		
Month	Rotation	Weekly Schedule (Monday-Sunday)
January	General Medicine	Mon-Fri: 07:00-16:00; Sat: 07:00-Sun 07:00 (on-call); Sun: Off
February	General Medicine	Mon-Fri: 07:00-16:00; Sat: 07:00-Sun 07:00 (on-call); Sun: Off
March	General Medicine	Mon-Fri: 07:00-16:00; Sat: Off; Sun: Off
April	General Surgery	Mon-Fri: 07:00-16:00; Sat: 07:00-Sun 07:00 (on-call); Sun: Off
May	General Surgery	Mon-Fri: 07:00-16:00; Sat: Off; Sun: Off
June	General Surgery	Mon-Fri: 07:00-16:00; Sat: 07:00-Sun 07:00 (on-call); Sun: Off
July	Paediatrics	Mon-Fri: 07:00-16:00; Sat: Off; Sun: Off
August	Paediatrics	Mon-Fri: 07:00-16:00; Sat: 07:00-Sun 07:00 (on-call); Sun: Off
September	Paediatrics	↓ Mon-Fri: 07:00-16:00; Sat: Off; Sun: Off
October	Obstetrics and Gynaecology	Mon-Fri: 07:00-16:00; Sat: 07:00-Sun 07:00 (on-call); Sun: Off
November	Obstetrics and Gynaecology	Mon-Fri: 07:00-16:00; Sat: Off; Sun: Off
December	Obstetrics and Gynaecology	Mon-Fri: 07:00-16:00; Sat: 07:00-Sun 07:00 (on-call); Sun: Off
January	Anaesthesiology	Mon-Fri: 07:00-16:00; Sat: Off; Sun: Off
February	Anaesthesiology	Mon-Fri: 07:00-16:00; Sat: 07:00-Sun 07:00 (on-call); Sun: Off
March	Orthopaedics	Mon-Fri: 07:00-16:00; Sat: Off; Sun: Off
April	Orthopaedics	Mon-Fri: 07:00-16:00; Sat: 07:00-Sun 07:00 (on-call); Sun: Off
May	Psychiatry	Mon-Fri: 07:00-16:00; Sat: Off; Sun: Off
June	Psychiatry	Mon-Fri: 07:00-16:00; Sat: 07:00-Sun 07:00 (on-call); Sun: Off
July-December	Family Medicine (Emergency Dept.)	↓ Mon-Fri: 07:00-16:00; Sat: Off; Sun: Off (every other weekend on-call)

Figure 8: Initial ideal generic work schedule

CRITICAL APPRAISAL OF THE IDEAL GENERIC WORK SCHEDULE

The response presented a simplified initial generic work schedule illustrated in Figure 8, which only accounted for conditions 3 and 4. However, it did not accurately address condition 1 and condition 2; in particular, the allocation of calls, working hours, teaching time, and meal breaks were not considered as stipulated in

condition 1. Further, the total number of patients an intern is expected to see was not addressed as stipulated in condition 2.

Additional training on conditions 1-4 was conducted. Clarity was requested in the numbers calculated, mistakes were acknowledged and corrections made. ChatGPT 4.0 maintained consistency during training when asked to “amend” the schedule with each iteration and correction prompt provided. This approach preserved all other aspects of the schedule and only amended the specified requests. In contrast, if mistakes were just highlighted without requesting for an “amendment” to the schedule, the response would be the creation of an entirely new and inconsistent schedule.

The final ideal generic work schedule was created ensuring compliance with all conditions specified as illustrated in Figure 9. Different work schedules were provided for each specialty domain according to condition 2, which refers to the number of patients an intern can see per hour. The final ideal generic work schedule for General Medicine, General Surgery, and Paediatrics, where interns can only see two patients per hour, is shown in Figure 10. The work schedule had no 24- hour calls to ensure compliance to the regulated maximum 20-hours overtime per week. Continuous shift working hours and the 60-hours weekly limit were adhered to. Meal breaks were considered, teaching ward rounds and tutorials were ensured, and one full weekend off in a month was catered to as stipulated in HPCSA regulations.

ChatGPT 4.0 was given a final prompt to write an Excel code to generate the ideal generic work schedule as illustrated in Appendix A, which can be used to create department specific work schedules for CHBAH interns.

1. Normal Duty Reduced on Call Days				
Tuesday: Work only 07:00–12:00 before the call shift to limit normal duty to 40 hours per week.				
2. Call Shifts Limited to 20 Hours Per Week				
- Tuesday call (16:00–07:00) contributes 14 hours to overtime. - Saturday call (07:00–19:00) contributes 12 hours to overtime, but with 3 hours meal breaks deducted, ensuring total weekly overtime stays ≤ 20 hours.				
3. One Free Weekend Per Month				
Week 3: No weekend call, ensuring at least one full weekend off as required.				
Day	Normal Duty Hours	Call/Overtime Hours	Hours	Notes
Monday	8 hours (07:00–16:00)	0	8	Normal day
Tuesday	5 hours (07:00–12:00)	14 hours (16:00–07:00 next day)	19	Call day
Wednesday	2 hours (Post-call ward round, 07:00–09:00)	0	2	Post-call
Thursday	8 hours (07:00–16:00)	0	8	Normal day
Friday	8 hours (07:00–16:00)	0	8	Includes tutorial
Saturday	0	12 hours (07:00–19:00)	12	Weekend call
Sunday	3 hours (Post-call ward round, 07:00–10:00)	0	3	Post-call
Total Weekly Hours	40	20	60	 Compliant
 This schedule now fully complies with: - Maximum 40 hours normal duty. - Maximum 20 hours of calls/overtime. 60-hour workweek limit. - Post-call recovery times included. - Learning components (ward rounds & tutorials) maintained.				

Figure 9: Adjustments made to ensure a compliant final ideal generic work schedule

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Patients	Weekly Hours
Week 1	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-16:00 (6 patients)	07:00-08:00 (Ward round), 08:00-12:00 (5 patients), Call: 16:00-07:00 (22 patients incl. meal breaks)	Post-call ward round (07:00-09:00), Off	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-16:00 (6 patients)	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-15:00 (6 patients), 15:00-16:00 (Tutorial)	Call: 07:00-19:00 (24 patients incl. meal breaks)	Post-call ward round (07:00-10:00), Off	99 patients	60 hours
Week 2	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-16:00 (6 patients)	07:00-08:00 (Ward round), 08:00-12:00 (5 patients), Call: 16:00-07:00 (22 patients incl. meal breaks)	Post-call ward round (07:00-09:00), Off	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-16:00 (6 patients)	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-15:00 (6 patients), 15:00-16:00 (Tutorial)	Call: 07:00-19:00 (24 patients incl. meal breaks)	Post-call ward round (07:00-10:00), Off	99 patients	60 hours
Week 3	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-19:00 (6 patients)	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-16:00 (6 patients)	07:00-12:00 (5 patients), Call: 16:00-07:00 (22 patients incl. meal breaks) → 18-hour shift	Post-call ward round (07:00-09:00), Off	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-19:00 (6 patients), 15:00-16:00 (Tutorial)	Off (Free weekend)	Off (Free weekend)	99 patients	60 hours
Week 4	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-16:00 (6 patients)	07:00-08:00 (Ward round), 08:00-12:00 (5 patients), Call: 16:00-07:00 (22 patients incl. meal)	Post-call ward round (07:00-09:00), Off	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-16:00 (6 patients)	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-15:00 (6 patients), 15:00-16:00 (Tutorial)	Call: 07:00-19:00 (24 patients incl. meal breaks)	Post-call ward round (07:00-10:00), Off	99 patients	60 hours

Figure 10: Final ideal generic work schedule for medical interns compliant with HPCSA regulations

4.2.2 CHBAH current work schedules

Following the development of an ideal generic HPCSA compliant work schedule for interns using ChatGPT 4.0, the next step entailed an assessment of the practical CHBAH work environment. The specialty domains at CHBAH all have unique work structures, and it is important to understand that to evaluate compliance with HPCSA regulations, as well as in creating efficient intern work schedules per department.

November 2024 intern work schedules were analysed for the top five departments with the highest patient volumes in 2023 as illustrated in Table 3, which included, General Medicine, Obstetrics and Gynaecology, General Surgery, Anaesthesiology and Family Medicine MEU.

The following medical internship HPCSA conditions were evaluated to assess compliance in each of the five departments:

1. **“80-hours overtime per month** should not be exceeded in a four-week cycle.
2. Continuous/extended shifts should not exceed **26-hours**.
3. Interns are expected to work a **maximum of 60-hours per week** which includes **a maximum of 40-hours per week during normal hours** and a **maximum of 20-hours per week of overtime**.
4. Each intern should manage **15-25 in-patient beds**, ensuring a balance between clinical exposure and manageable workload. (HPCSA, 2023)”

A. GENERAL MEDICINE

Interns are allocated to General Medicine for 3-months during the first year of their internship training. In 2023, this department recorded the highest patient admissions with a total of 26304.

a. Description of work structure

The information on work structure was provided by the Head of Department. The department consists of five units (Unit 1 to Unit 5) led by consultants, and interns are evenly distributed across the five units. Each unit follows a 5-day work cycle:

Day 1: Intake call

Day 2: Post Intake

Day 3: Ward Round + Mini Intake call (MIC) + Ward Call

Day 4: Ward Round + MIC

Day 5: Ward Round + MIC

The General Medicine department admits approximately 90-120 patients daily. Admissions to the department occur during Intake calls, and Mini-Intake calls (MIC) for each unit. Patients are initially assessed in the Medical Emergency Unit (MEU) by the Emergency Department team, and those requiring admission will be referred to the General Medicine department. The interns play a critical role in the General Medicine department because they are responsible for all admitted patients. Every intern takes care for their admitted patients until discharge, therefore ensuring continuity of care.

During patient admission, the intern is required to take an extensive history from the patient, examine the patient, establish a possible diagnosis, and develop a plan to investigate and confirm the diagnosis, as well as a plan to treat the patient. After the intern has completed that process, they will present to their registrar who will also examine the patient and assess whether the intern has correctly established a possible diagnosis and a solid plan to manage the patient adequately. Ideally, interns should see two patients per hour to manage patient load during admissions, but in reality, only one patient is seen. That unfortunately leads to long patient waiting times, and registrars often intervene by seeing patients themselves which impacts the intern's learning experience.

The unit's intake calls are from 07h00-07h00 the following day and all interns in the unit are required to report for duty at 07h00. The unit on call has two teams on duty, namely, the day intake (DI) team and the night intake (NI) team. The DI team comprises about 3-4 interns and three registrars who will work from 07h00-22h00, and the NI team will have about 4-5 interns and two registrars who will work from 07h00 until their daily ward round and ward work is complete, usually around 13h00,

and they will return to work at 22h00 to relieve the DI team. The unit on Intake call manages only emergency cases referred from the MEU between 07h00-14h00. After 14h00, the unit will manage both emergencies and non-emergencies.

Post Intake (PI) begins at 07h00, marking the end of Intake call. A teaching post intake ward round (PIWR) begins at 07h30 and it involves presentation and discussion of all newly admitted patients in the unit with the consultants. After the PIWR, the NI team continues to work until their ward work is complete, usually around 13h00, while the DI team remains on duty for the regular workday until 16h00.

General working hours on days 3, 4, and 5 when the intern is neither on intake call nor PI are from 07h00-16h00. Their day typically begins with a ward round where they review their admitted patients with their registrar +/-their consultant. This ward round generally sees five patients per hour and finishes around 11h00. The intern will perform their ward work thereafter, which are tasks assigned by the registrar +/- consultant during the ward round and may include performing procedures such as blood tests or lumbar punctures, ordering X-rays, or preparing discharge summaries for patients.

Mini-intake calls (MIC) are scheduled on days 3, 4, and 5. During MIC, the three units that are neither on intake call nor PI will admit non-emergency patients referred by the MEU between 07h00-14h00. These patients are evenly distributed among the three units and once ward work is complete, two interns from each of the three units will see and present those patients to the registrar from their unit assigned to supervise them during the MIC. Depending on how busy the day is and how organised the intern is, interns typically finish between 16h00-19h00.

Ward calls (WC) are from 16h00-07h00 during the weekday, and 12h00-07h00 on weekends. Two interns from the unit on Day 3 of the 5-day cycle will start their normal workday at 07h00 and may or may not get a break before WC commences at 16h00. During the WC, interns will respond to emergencies for admitted patients across all units in the department. Once WC officially ends at 07h00, the interns must report to their unit for the ward round and can only leave after completing ward work, usually around 13h00.

During weekends, if the unit is on intake call or PI, all the interns from that unit will be on duty from 07h00. If the unit is neither on intake call nor PI, then half the interns per unit will report to work to manage their units' admitted patients and may only leave once ward work is complete, usually around 13h00.

Other duties include Medical Outpatients Department (MOPD) which is an outpatient clinic scheduled once a week per unit.

Annual Leave is mandatory for all interns. Interns are required to take off five working days during the 3-months of the General Medicine rotation.

b. Critical Analysis of the General Medicine work schedule

According to the description of the work structure provided, the following time frames were utilised in the analysis of the November 2024 General Medicine intern work schedule:

Day Intake (DI) call: 07h00-22h00= 15-hours

Post Intake (PI) for the DI team: 07h00-16h00= 9-hours

Night Intake (NI) call: (07h00-13h00=6hrs) + (22h00-07h00=9hrs) = 15-hours

PI for the NI team: 07h00-13h00= 6-hours

Ward Calls (WC): 16h00-07h00= 15-hours

Post Ward call: 07h00-13h00= 6-hours

Mini-Intake call (MIC): 13h00-17h00= 4-hours

Ordinary workday: 07h00-16h00

It should be noted that these times can vary for each intern daily. However, for the purpose of this study, the average times were utilised, and meal breaks were excluded.

The November 2024 intern work schedule indicated that each unit was allocated seven interns. An analysis was conducted on a single unit in the department, and the calls for the seven interns are summarised in Table 6.

	Day Intake: 07h00-22h00=15hrs	Night Intake: (07h00-13h00=6hrs) + (22h00-07h00=9hrs)=15hrs	WC: 16h00-07h00=15hrs	Total number of calls	Total hours worked on calls
Intern 1	3	3	2	8	120
Intern 2	3	3	1	7	105
Intern 3	2	2	2	6	90
Intern 4	2	3	1	6	90
Intern 5	1	4	2	7	105
Intern 6	2	4	2	8	120
Intern 7	2	4	2	8	120

Table 6: Total calls per intern in a single unit for November 2024

In evaluating compliance with HPCSA regulations concerning monthly overtime, an analysis was conducted on Intake calls and Ward calls (WC). It should be noted that MICs were excluded from this assessment as they are performed during normal working hours and therefore do not qualify as overtime. Three interns worked a total of eight calls totalling 120-hours monthly overtime. It was observed that Interns 3-5 worked 4, 5, and 5 Intake calls respectively, instead of the expected six intake calls worked by the unit. This is likely due to them taking leave resulting in their total monthly overtime being lower, with Interns 3 and 4 working 90-hours, and Intern 5 working 105-hours. It was also observed that the unit worked a total of six WC for the month. With only two interns assigned to each WC, it means two interns worked one less WC, as seen with Intern 2 who was not on leave but worked a total of 105-hours overtime. In conclusion, all interns exceeded the HPCSA regulated 80-hours monthly overtime limit, indicating non-compliance.

In evaluating compliance with HPCSA regulations concerning continuous shift hours, interns work continuous 15-hour shifts during the day intake call from 07h00-22h00, and during night intake call from 22h00-13h00 the following day. During Ward call, interns can work 21-hour continuous shifts from 16h00-13h00. However, since the intern starts work at 07h00, if they do not get a break before WC begins at 16h00, they end up working 30-hours from 07h00-13h00 the following day, resulting in non-compliance with the HPCSA 26-hours continuous shift limit.

In evaluating compliance with HPCSA weekly working hours, Table 7 was used to determine the total hours Intern 1 worked per week during November 2024.

Intern 1: Week 1	Mon 4th D2 PI	Tues 5th D3 WR+WW+WC	Wed 6th D4 WR+WW	Thrs 7th D5 WR+WW+MIC	Fri 8th D1 Intake	Sat 9th D2 PI	Sun 10th D3 Off	Total
Time	07h00-16h00	(07h00-13h00)+(16h00-07h00)	07h00-13h00	07h00-17h00	(07h00-13h00)+(22h00-07h00)	07h00-13h00		
Hrs	9	21	6	10	15	6	0	67
Intern 1: Week 2	Mon 11th D4 WR+WW+MIC	Tues 12th D5 Normal Workday	Wed 13th D1 Intake	Thrs 14th D2 PI	Fri 15th D3 Normal Workday	Sat 16th D4 Cover	Sun 17th D5 Cover	Total
Time	07h00-17h00	07h00-16h00	(07h00-13h00)+(22h00-07h00)	07h00-13h00	07h00-16h00	07h00-13h00	07h00-13h00	
Hrs	10	9	15	6	9	6	6	61
Intern 1: Week 3	Mon 18th D1 Intake	Tues 19th D2 PI	Wed 20th D3 WR+WW+WC	Thrs 21st D4 WR+WW	Fri 22nd D5 WR+WW+MIC	Sat 23rd D1 Intake	Sun 24th D2 PI	Total
Time	(07h00-13h00)+(22h00-07h00)	07h00-13h00	(07h00-13h00)+(16h00-07h00)	07h00-13h00	07h00-17h00	07h00-22h00	07h00-16h00	
Hrs	15	6	21	6	10	15	9	82
Intern 1: Week 4	Mon 25th D3 Normal Workday	Tues 26th D4 WR+WW+MIC	Wed 27th D5 Normal Workday	Thrs 28th D1 Intake	Fri 29th D2 PIWR+WW+MOPD	Sat 30th Off	Sun 01st Off	Total
Time	07h00-16h00	07h00-17h00	07h00-16h00	07h00-22h00	07h00-16h00			
Hrs	9	10	9	15	9	0	0	52

Table 7: Weekly hours worked by Intern 1 in November 2024

During week 1, Intern 1 worked 67-hours which exceeded the 60-hour total weekly limit by 7-hours. This is likely due to 30-hours overtime worked during the 15-hour Ward call (WC) on Tuesday and the 15-hour Intake call on Friday, exceeding the 20-hours weekly overtime limit. The intern worked 61-hours during week 2, and 82-hours during Week 3, both exceeding the 60-hour weekly limit. The 20-hours weekly overtime limit was also exceeded in week 3, with the intern working 2 Intake calls, and a 15-hour WC, totalling 45-hours weekly overtime. During week 4, the intern worked a total of 52-hours with 15-hours weekly overtime, both below the regulated 60-hours and 20-hours limit, respectively. The assessment of the weekly schedule indicates poor compliance to the HPCSA regulated 60-hours weekly limit, due to the excess overtime worked above the 20-hours weekly overtime limit during weeks 1 and 3.

In evaluating compliance to patient workload, four methods were utilised to assess consistency. Table 8 provides a summary of the total hours worked during patient admission for a single unit, encompassing hours worked on both Intake calls and MIC.

	Day Intake: 07h00-22h00=15hrs	Night Intake: (07h00-13h00=6hrs) + (22h00-07h00=9hrs)=15hrs	MIC: 13h00-17h00=4hrs	Total hours worked on admission
Intern1	3	3	4	106
Intern2	3	3	4	106
Intern3	2	2	3	72
Intern4	2	3	3	87
Intern5	1	4	4	91
Intern6	2	4	4	106
Intern7	2	4	4	106
TOTAL	225	345	104	674

Table 8: Total monthly admissions for a single unit

For the seven interns in the single unit analysed, a total of 225-hours were worked on day intake, 345-hours on night intake, and 104-hours on MIC during November 2024. This is a total of 674-hours in a month for one unit. If an intern admits one patient per hour, it means a total of 674 patients were admitted to the one unit in a month. If divided amongst the seven interns in the unit, it would imply that each intern admits approximately ninety-six patients a month, and therefore twenty-four weekly admissions. This is aligned with the HPCSA requirements for an intern to manage 15-25 in-patient beds. However, if an intern does not discharge all patients admitted the previous week, which is likely, it would result in an increased patient load for the intern.

Alternatively, we can evaluate patient workload by considering the information that approximately 90-120 patients are admitted to the department daily. If the three units on MIC duty see four patients each in the 4-hours from 13h00-17h00, it would mean twelve patients less for the unit on intake call. The unit on intake call will therefore admit 78-108 patients, and divided among the seven interns, each intern would admit 11-15 patients. An additional four patients will be added when the intern does their weekly MIC, increasing the total number of admitted patients per intern to 15-19 weekly which complies with the HPCSA regulations. However, as established on Table 7, an intern can work two intake calls a week, which will add 11-15 patients, increasing the number of admitted patients per intern to 26-34 per week. This method too is unreliable as the weekly discharge rate is not considered, which varies depending on the patient condition.

Also based on information provided about five patients seen per hour during the daily ward round from 07h00-11h00, patient workload can be assumed to be approximately twenty in-patients per intern which also complies with the HPCSA limit.

Patient workload was also evaluated from a different perspective, utilising the total number of admissions to the General Medicine department in 2023. If 26304 patients were admitted in a year, it means 2192 patients were admitted on average per month. If that is divided amongst the forty interns allocated to the General Medicine department in 2023, it would mean each intern managed fifty-five patients per month, which is approximately fourteen patients per week.

Based on the assessment from all four methods used in evaluating patient workload, it is estimated that an intern manages between 14-34 in-patients which is an average of twenty-four in-patients. This complies to the HPSCA regulated workload limit of 15-25 in-patient beds.

c. Conclusion

The General Medicine department was assessed to be non-complaint with HPCSA regulations with regards to intern overtime, and weekly working hours. However, compliance was noted with regards to continuous shift hours if a break was awarded before Ward call, as well as with regards to patient workload.

B. OBSTETRICS AND GYNAECOLOGY

Interns spend 3-months rotating through the department in their first year, with 2-months allocated to Obstetrics and 1-month to Gynaecology. This department recorded the second highest patient admissions in 2023, with a total of 25494.

a. Description of work structure

The information was provided by two consultants of which one is the department's intern co-ordinator. There are five units (Units A-E) in both Obstetrics and in Gynaecology, with interns evenly allocated across units A-E. One-third of the interns

in each unit, such as Unit A, will spend 1-month working in Gynaecology Unit A, while the remaining two-thirds will work in Obstetrics Unit A during the same period. After the 1-month period, interns who worked in Gynaecology will rotate with those in the corresponding Obstetrics unit. The daily duties in both Obstetrics and Gynaecology are different, however, they both follow a 5-day cycle.

i. ***Obstetrics rotation***

During the Obstetrics rotation, interns will acquire knowledge and experience in managing patients who are more than 24-weeks pregnant. Due to the high patient turnover, interns are often unable to follow-up patients they admitted until discharge, unlike during the General Medicine rotation. Each unit will follow the 5-day work cycle as outlined below:

Day 1: Intake call

Day 2: Post Intake (PI)

Day 3: Antenatal Clinic (ANC)

Day 4: Admissions (AD)

Day 5: Labour Ward (LW)

The unit on Intake call works 15,5-hours from 16h00-07h30 the following day. All interns in the unit get pre-call, which means they do not come to work in the morning and only present for duty at 16h00 when the call begins. Post Intake starts with a Post Intake Ward Round at 07h30 and the interns may leave after completing their ward work, usually around 11h00-12h00.

On days 3, 4, and 5 when the unit is neither on intake call nor PI, the intern will start at 07h30 with the ward round accompanied by their registrar. Together they will review their assigned patients in the wards, which is approximately fifteen patients. Thereafter the intern is required to do ward work and then attend to daily duties, which include ANC on day 3, and Labour Ward on day 5. On day 4, the intern and their entire unit are expected to start at 07h30 in Admissions Ward, which exempts them from attending ward rounds or performing ward work. Daily duties on days 3,

4, and 5 are all scheduled to end at 16h00, however, it may vary depending on patient load.

During weekends, the unit allocated to Labour Ward duty, will present to work from 07h30-16h00 for a weekend day call. They will be joined by two interns allocated to a weekend cover who will ensure ward work is complete before they leave.

ii. *Gynaecology rotation*

During the gynaecology rotation, each unit (A-E) adheres to the 5-day cycle as follows:

Day 1: Call/Intake

Day 2: Post Intake (PI)

Day 3: Gynae Elective Theatre (GET)

Day 4: Cold Case (CC)

Day 5: Follow up Clinic (FUC)

Call/intake for the unit is 24-hours from 08h00-08h00 the following day. Post Intake begins at 08h00 with a PIWR and interns manage to leave work around 10h00-11h00 after completing ward work.

The unit begins days 3, 4, and 5 with a consultant ward round at 07h30. Thereafter, interns will do ward work, and then attend to daily duties, which are theatre on day 3, cold case clinic on day 4, and then follow up clinic on day 5, all of which are meant to finish at 16h00.

During weekends, the unit on call will also manage admitted patients, and therefore there is no weekend cover required.

b. Critical Analysis of the Obstetrics and Gynaecology work schedule

i. Obstetrics rotation

The November 2024 intern work schedule shows a total of twenty-six interns allocated to Obstetrics. Four Units were each allocated five interns, and only one unit was allocated six interns.

In evaluating compliance with HPCSA regulations concerning overtime, Table 9 provides a summary of the total overtime hours worked per unit. The calls evaluated include intake calls from 16h00-07h30, as well as weekend day calls from 07h30-16h00. Each unit worked a total of six intake calls amounting to 93-hours, and five units had an additional two weekend day calls resulting in a total of 110-hours overtime in a month. This is 30-hours above the recommended 80-hours monthly overtime limit. Unit E worked one weekend day call, resulting in 101,5-hours overtime, which exceeds the 80-hours limit by 21,5-hours. This discrepancy is because they were allocated their second weekend day call on Sunday 01 December, which was excluded for the purpose of this study, which only focused on the period from 01 November- 30 November 2024.

	# of Interns	# of calls per unit (16h00-07h30) =15,5hrs	# of weekend day calls (07h30-16h00) =8,5hrs	Total hours on call
Unit A	6	6	2	110
Unit B	5	6	2	110
Unit C	5	6	2	110
Unit D	5	6	2	110
Unit E	5	6	1	101,5
Total	26	30	9	541,5

Table 9: Total overtime hours worked per unit in November 2024

In evaluating compliance with HPCSA regulations concerning the 26-hour continuous shift limit, compliance was noted as interns work 19,5 continuous hours, consisting of 15,5-hours intake call and an additional 4-hours PI.

In evaluating compliance with HPCSA regulated weekly working hours, Table 10 was used to summarise one intern's weekly duties. The average time of 11h30 was

used as knock off time on PI days as it was mentioned that interns leave between 11h00 and 12h00.

Week 1	D1 Mon 4th Call (16h00-07h30)	D2 Tues 5th PI (07h30-11h30)	D3 Wed 6th ANC (7h30-16h00)	D4 Thurs 7th AD (7h30-16h00)	D5 Fri 8th LW (7h30-16h00)	D1 Sat 9th Call (16h00-07h30)	D2 Sun 10th PI (07h30-11h30)	Total
Hrs	15,5	4	8,5	8,5	8,5	15,5	4	64,5
Week 2	D3 Mon 11th ANC (07h30-16h00)	D4 Tues 12th AD (7h30-16h00)	D5 Wed 13th LW (07h30-16h00)	D1 Thurs 14th Call (16h00-07h30)	D2 Fri 15th PI (07h30-11h30)	D3 Sat 16th	D4 Sun 17th	Total
Hrs	8,5	8,5	8,5	15,5	4	0	0	45
Week 3	D5 Mon 18th LW (07h30-16h00)	D1 Tues 19th Call (16h00-07h30)	D2 Wed 20th PI (7h30-11h30)	D3 Thurs 21st ANC (7h30-16h00)	D4 Fri 22nd AD (07h30-16h00)	D5 Sat 23rd (07h30-16h00)	D1 Sun 24th Call (16h00-07h30)	Total
Hrs	8,5	15,5	4	8,5	8,5	8,5	15,5	69
Week 4	D2 Mon 25th PI (7h30-11h30)	D3 Tues 26th ANC (7h30-16h00)	D4 Wed 27th AD (7h30-16h00)	D5 Thurs 28th LW (7h30-16h00)	D1 Fri 29th Call (16h00-07h30)	D2 Sat 30th PI (07h30-11h30)	D3 Sun 1st (07h30-16h00)	Total
Hrs	4	8,5	8,5	8,5	15,5	4	8,5	57,5

Table 10: Weekly working hours for one intern

During week 1, the intern worked a total of 64,5-hours with 31-hours overtime from the two intake calls, therefore exceeding both the 60-hour weekly limit and the 20-hours weekly overtime limit, respectively. The intern worked 45-hours during week 2 which is below the 60-hours weekly limit. During week 3, the intern worked a total of 69-hours with 39,5-hours overtime from the two intake calls and the one weekend day call, thus exceeding both the 60-hours weekly limit and the 20-hours overtime weekly limit, respectively. During week 4, the intern worked 57,5-hours which is below the 60-hours weekly limit. However, the overtime worked was 24-hours which exceeds the 20-hours weekly overtime limit. During this week, Sunday 01 December was included as it is required for the weekly evaluation from Monday-Sunday. The evaluation of weekly working hours for the month revealed poor compliance to the HPCSA weekly working hours regulation.

In evaluating patient workload, the admissions data from 2023 was utilised. 25494 patients were admitted to the Obstetrics and Gynaecology department as illustrated in Table 3, of which 20315 patients were admitted in Obstetrics as shown in Table 4. This means, the average number of patients admitted per month is 1693 which will be divided among the twenty-six interns. This will result in the intern managing approximately sixty-five patients a month which is sixteen patients weekly on

average. This is aligned with the information provided that the interns manage approximately fifteen in-patients.

ii. ***Gynaecology rotation***

An analysis of the November 2024 intern work schedule showed a total of ten interns allocated to Gynaecology. Each unit was only allocated two interns, and if one took leave, one intern from the corresponding Obstetrics unit will be excused from their Obstetrics unit call and would work the Gynaecology call from 16h00.

	# of Interns	# of calls per unit	Total hours on call : (08h00-08h00) =24hrs
Unit A	2	6	144
Unit B	2	6	144
Unit C	2	6	144
Unit D	2	6	144
Unit E	2	6	144
Total	10	30	720

Table 11: Total hours on call during Gynaecology November 2024 rotation

In evaluating compliance with the HPCSA regulations concerning monthly overtime, Table 11 indicates that all units worked six calls totalling 144-hours, which exceeds the 80-hours monthly overtime limit.

In evaluating compliance with continuous shift hours, it is said interns leave between 10h00-11h00 on post intake days. By utilising the average PI knock off time as 10h30, interns would work a continuous 24-hour Intake call followed by 2,5-hours PI which is 26,5-hours, and therefore 30-min above the regulated 26-hour limit.

In evaluating compliance with weekly hours, Table 12 provides a summary of the total weekly hours worked by an intern in a single unit assessed.

Week 1	D1 Mon 4th Call (8h00-8h00)	D2 Tues 5th PI (08h00-10h30)	D3 Wed 6th GET (7h30-16h00)	D4 Thurs 7th CC (7h30-16h00)	D5 Fri 8th FUC (7h30-16h00)	D1 Sat 9th Call (8h00-8h00)	D2 Sun 10th PI (08h00-10h30)	Total
Hrs	24	2,5	8,5	8,5	8,5	24	2,5	78,5
Week 2	D3 Mon 11th GET (07h30-16h00)	D4 Tues 12th CC (7h30-16h00)	D5 Wed 13th FUC (07h30-16h00)	D1 Thurs 14th Call (8h00-8h00)	D2 Fri 15th PI (08h00-10h30)	D3 Sat 16th	D4 Sun 17th	Total
Hrs	8,5	8,5	8,5	24	2,5	0	0	52
Week 3	D5 Mon 18th FUC (07h30-16h00)	D1 Tues 19th Call (8h00-8h00)	D2 Wed 20th PI (08h00-10h30)	D3 Thurs 21st GET (7h30-16h00)	D4 Fri 22nd CC (07h30-16h00)	D5 Sat 23rd	D1 Sun 24th Call (8h00-8h00)	Total
Hrs	8,5	24	2,5	8,5	8,5	0	24	76
Week 4	D2 Mon 25th PI (08h00-10h30)	D3 Tues 26th GET (7h30-16h00)	D4 Wed 27th CC (7h30-16h00)	D5 Thurs 28th FUC (7h30-16h00)	D1 Fri 29th Call (8h00-8h00)	D2 Sat 30th PI (08h00-10h30)	D3 Sun 1st	Total
Hrs	2,5	8,5	8,5	8,5	24	2,5	0	54,5

Table 12: Total weekly hours for an intern during Gynaecology rotation

During week 1, the intern worked a total of 78,5-hours with 48-hours overtime, therefore exceeding both the 60-hours weekly limit and the 20-hours weekly overtime limit, respectively. During week 2, the intern worked 52-hours which exceeds the 60-hour limit. With 24-hour calls, non-compliance is observed weekly as interns work above the 20-hours weekly overtime limit. During week 3, the intern worked a total of 76-hours which exceeds the 60-hour limit. However, during week 4, the intern worked 54,5-hours which is 5,5-hours below the 60-hour limit. There is therefore poor compliance with the total weekly hours worked, and the 20-hours weekly overtime limit is always exceeded.

In evaluating patient workload, 5179 patients were admitted to Gynaecology in 2023 as illustrated in Table 4. In a month, the ten interns will manage an estimated 431 patients. This means each intern manages approximately forty-three patients per month and therefore ten patients a week which is below the HPCSA limit.

c. Conclusion

The evaluation of the Obstetrics and Gynaecology department intern work schedule revealed poor compliance to HPCSA regulations with regards to intern overtime, and weekly working hours. Compliance was achieved with regards to continuous shift hours during Obstetrics rotation and was slightly above the regulated hours

during the Gynaecology rotation. However, patient workload did not exceed the HPCSA limit during both Obstetrics and Gynaecology rotations.

C. GENERAL SURGERY

Interns rotate through General Surgery for 3-months during their first year internship training. In 2023, this department recorded the third highest patient admission of 19238.

a. Description of work structure

The information was provided by the General Surgery intern co-ordinator. The department is divided into eight units where interns are allocated for the entire 3-months duration of their rotation.

Unit 1- Specialises in Hepatobiliary conditions.

Unit 3- Specialises in Colorectal conditions.

Unit 4- Specialises in Breast conditions.

Unit 5- Specialises in Endocrine surgical conditions.

Burns Unit- Specialises in burns management.

Vascular Unit- Specialises in Vascular surgical conditions.

Acute Care Surgery (AC) Unit- Admits all general surgery patients from the Surgical Emergency Unit (SEU) and will transfer some patients to the above mentioned six subspecialty units.

Trauma unit- Manages all the trauma patients from the Trauma Emergency Unit (TEU), and those requiring admission will be admitted to the Trauma unit wards.

The allocation of interns to each unit is determined by the unit's workload. In general, the busiest units are Trauma and AC units, followed by Unit 1. Unit 3, 4, and 5 are allocated same number of interns, while both the Burns and Vascular units have the

least. Units with a high patient load will be allocated CSMOs, and interns from less busy units may assist when necessary. Trauma Unit also receives elective and international students who help manage the workload.

Intern calls are 24-hours and are allocated randomly. Unlike during the General Medicine and Obstetrics and Gynaecology rotations, interns in General Surgery do not work calls with their units. During a call, the intern will either work in the SEU, TEU, or do a Ward call. Interns will work all three calls monthly, except for Trauma unit interns who do not work SEU calls. The intern on SEU/TEU call will start work at 07h30 and at times may need to start in their respective units for the ward round, ward work, and other unit duties and only go to SEU/TEU at 16h00. Sometimes they start the call immediately from 07h30-07h30 the following day. However, the intern on Ward call (WC) will work their normal duties from 07h30 and only begin the WC at 16h00. The intern on WC is required to follow-up critical patients and manage emergencies for all admitted patients across each unit. Even though some calls begin at 16h00, the intern does not receive pre-call and is not guaranteed a break before the call, hence all calls are considered 24-hour shifts.

Post intake (PI) for an intern who was working a SEU/TEU call begins with the post-call ward round at 07h30 until approximately 09h00. The intern is required to complete post-call ward work before going to their home units to assist with ward work. Depending on workload, the intern typically leaves between 11h00-12h00. The intern post WC is required to report to their unit for the ward round at 07h30, followed by ward work before they can leave.

When not on call or PI, the intern will work normal working hours from 07h00-16h00. They will start with ward rounds, complete their ward work, and then attend unit-specific duties such as theatre, or Surgical Outpatients Department (SOPD).

During the weekend, interns work 1-2 weekend covers for their unit from 08h00 until approximately 12h00, but for the busy units they usually finish at 16h00.

b. Critical Analysis of General Surgery Work Schedule

An analysis of the General Surgery November 2024 intern call work schedule is summarised in Table 13. A total of thirty-six interns were allocated to the department

with nine interns allocated to the Trauma unit, eight interns to AC unit, five interns to Unit 1, four interns to Unit 3, three interns each to Unit 4 and Unit 5, and two interns each to Burns and Vascular units.

In evaluating compliance with HPCSA regulations concerning monthly overtime, Figure 11 was used to analyse the actual hours worked per intern compared to the regulated 80-hours limit. It was observed that only thirty-five interns worked a total of 212 calls as Trauma Intern 2 was not allocated calls for unknown reasons. Only one intern worked 96-hours, and seven interns worked 120-hours. On average, interns worked six calls amounting to 144-hours per month. However, nine interns each worked seven calls totalling 168-hours, and one intern worked eight calls totalling 192-hours. All thirty-five interns exceeded the recommended 80-hours monthly overtime limit.

INTERN	TEU CALL	SEU CALL	WARD CALL	TOTAL # OF CALLS	TOTAL HOURS ON CALL
Trauma 1	5	1	0	6	144
Trauma 2	0	0	0	0	0
Trauma 3	6	1	0	7	168
Trauma 4	6	1	0	7	168
Trauma 5	5	1	0	6	144
Trauma 6	6	1	0	7	168
Trauma 7	6	1	0	7	168
Trauma 8	6	1	0	7	168
Trauma 9	7	1	0	8	192
AC 1	1	4	1	6	144
AC 2	1	2	1	4	96
AC 3	0	5	0	5	120
AC 4	0	5	1	6	144
AC 5	1	4	0	5	120
AC 6	2	2	1	5	120
AC 7	1	4	1	6	144
AC 8	1	4	1	6	144
Unit 1-1	2	2	2	6	144
Unit 1-2	1	3	1	5	120
Unit 1-3	1	2	2	5	120
Unit 1-4	2	4	0	6	144
Unit 1-5	2	2	1	5	120
Unit 3-1	2	3	1	6	144
Unit 3-2	2	3	1	6	144
Unit 3-3	2	2	2	6	144
Unit 3-4	1	2	2	5	120
Unit 4-1	2	3	1	6	144
Unit 4-2	1	4	1	6	144
Unit 4-3	3	3	1	7	168
Unit 5-1	2	3	2	7	168
Unit 5-2	1	5	1	7	168
Unit 5-3	2	2	2	6	144
Burns 1	3	2	1	6	144
Burns 2	3	2	1	6	144
Vascular 1	3	3	1	7	168
Vascular 2	4	1	1	6	144
TOTAL	93	89	30	212	5088

Table 13: Total call hours per intern in November 2024

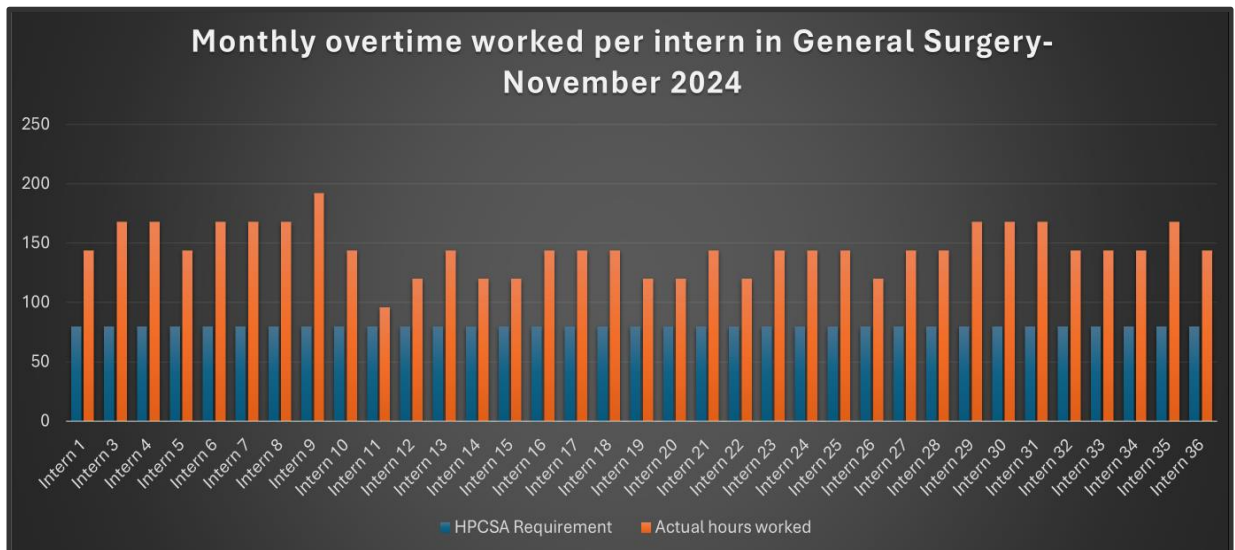


Figure 11: Monthly overtime worked per intern during General Surgery

In evaluating compliance with HPCSA concerning continuous shift hours, interns work 24-hour calls from 07h30-07h30 and only leave between 11h00-12h00 on post intake day. If an average post intake knock-off time of 11h30 is used, it means the interns work continuous 28-hours which exceeds the regulated 26-hours.

In evaluating weekly working hours, Table 14 and Figure 12 was utilised. Table 14 illustrates a simulated work schedule Intern AC7 could have possibly worked because the November work schedule provided only indicates calls and not daily allocations. Intern AC7 was selected to have their weekly work schedule simulated because they worked six calls, which is representative of the average number of calls, and they only started their calls on the 5th which helps to analyse a 7-day week starting from Monday 4th. Table 14 illustrates the days in blue as normal workdays from 07h00-16h00. Red represents 24-hour calls and green shows post intake days from 07h30-11h30. Yellow represents off duty weekends, and orange represents weekend cover days. It was mentioned interns work 1-2 weekend covers, and since the AC unit is a busy unit, Intern AC 7 will work 08h00-16h00.

AC7: Week 1	Mon 4th (7h00-16h00)	Tues 5th Call	Wed 6th PI (07h30-11h30)	Thrs 7th (7h00-16h00)	Fri 8th (7h00-16h00)	Sat 9th	Sun 10th Call	Total
Hrs	9	24	4	9	9	0	24	79
AC7: Week 2	Mon 11th PI (07h30-11h30)	Tues 12th (7h00-16h00)	Wed 13th Call	Thrs 14th PI (07h30-11h30)	Fri 15th (7h00-16h00)	Sat 16th	Sun 17th Call	Total
Hrs	4	9	24	4	9	0	24	74
AC7: Week 3	Mon 18th PI (07h30-11h30)	Tues 19th (7h00-16h00)	Wed 20th (7h00-16h00)	Thrs 21st Call	Fri 22nd PI (07h30-11h30)	Sat 23rd Cover (08h00-16h00)	Sun 24th Cover (08h00-16h00)	Total
Hrs	4	9	9	24	4	8	8	66
AC7: Week 4	Mon 25th (7h00-16h00)	Tues 26th (7h00-16h00)	Wed 27th (7h00-16h00)	Thrs 28th Call	Fri 29th PI (07h30-11h30)	Sat 30th	Sun 1st	Total
Hrs	9	9	9	24	4	0	0	55

Table 14: Simulated weekly duties for Intern AC 7

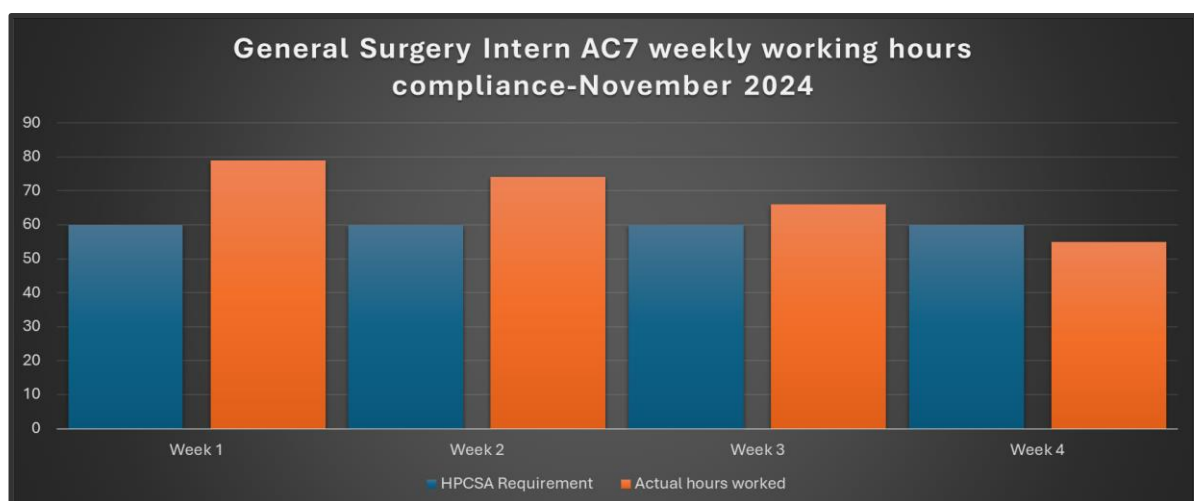


Figure 12: General Surgery weekly working hours compliance

It is evident from Figure 12 that Intern AC7 worked more than the 60-hour weekly limit during the first 3 weeks. They worked a total of 79-hours during week 1, 74-hours in week 2, and 66-hours in week 3. During week 4, Intern AC7 worked 5-hours less than the recommended 60-hours weekly limit. However, due to the 24-hour calls, the weekly overtime limit of 20-hours is always exceeded. Therefore, there is non-compliance with HPCSA regulated weekly working hours.

In evaluating compliance with patient workload, the 2023 admission data of 19238 for the General Surgery department was utilised as illustrated in Table 3. These are patients admitted from the SEU to the surgical wards. Since Trauma unit interns do

not work SEU calls, they will be excluded from this assessment. If the numbers of interns from November 2024 are used as an estimate, it means a total of thirty-six interns less nine Trauma unit interns. Therefore, twenty-seven interns would share the estimated 1603 monthly admitted patient load, resulting in each intern managing approximately sixty patients a month, which is fifteen patients weekly. However, as previously mentioned, the patient workload depends on discharge rate and varies across different units. Therefore, a blanket approach as above could possibly be misleading and not representative of the real work environment. However, for ease and purpose of this study, it is estimated that interns manage approximately fifteen in-patients which is compliant with HPCSA regulations.

c. Conclusion

The evaluation of the General Surgery department intern work schedule revealed poor compliance with HPCSA regulations with regards to overtime hours, continuous shift hours, and weekly working hours. There was however compliance noted with regards to patient workload.

D. ANAESTHESIOLOGY

Interns rotate through Anaesthesiology department for 2-months during their second year. The department had the highest patient count as illustrated in Table 3, with an estimated total of 74060 patients seen in 2023. However, this department was allocated fewer interns compared with first year rotations as illustrated in Table 2. This is because the department only manages patients acutely and therefore does not admit and follow-up patients. The department is also allocated the highest number of qualified doctors (Medical Officers, registrars, and consultants) as illustrated in Table 1. This all allows for the department to function adequately with the minimum number of interns allocated.

a. Description of work structure

The information was provided by the Anaesthesiology intern co-ordinator. During the rotation, two interns are paired with a registrar/MO and work together as a team for all their duties and calls for the 2-months.

A normal workday for an intern who is neither on call nor post call is from 07h30-16h00. Overtime for interns constitutes approximately 1-2 calls per week including weekends. During a weekday call, the interns get pre-call and only present to work for 16-hours from 16h00-08h00 the following day. During the weekend call, interns can work only 2 days which can either be Friday night (16h00-08h00) plus Sunday day (08h00-16h00), or Saturday day plus Sunday night. Alternatively, they can work only 1 day on Saturday night because there is no pre-call or post call awarded as with Friday nights and Sunday nights, respectively. On a post call day, the intern leaves exactly at 08h00, except Fridays when they leave at 09h00 due to compulsory tutorial. The department does not rely on interns; therefore, not all calls have interns allocated.

The HPCSA requirement for intern competency is to have eighty cases completed and signed-off in the 2-months. However, most of the interns will have 100-120 cases completed.

b. Critical Analysis of the Anaesthesiology work schedule

The Anaesthesiology November 2024 intern work schedule was analysed and revealed that the department was allocated twenty-seven interns who worked in thirteen teams, and Intern T was the only one unpaired as summarised on Table 15.

Team	Night Call 16h00-08h00= 16hrs	Weekend Day Call 08h00-16h00= 8hrs	Total Call Hours
Team A- Interns 1&2	4	1	72
Team B- Interns 3&4	4	1	72
Team C- Interns 5&6	4	0	64
Team D- Interns 7&8	4	1	72
Team E- Interns 9&10	3	2	64
Team F- Interns 11&12	3	1	56
Team G- Interns 13&14	3	1	56
Team H- Interns 15&16	3	2	64
Team K- Interns 17&18	3	1	56
Team L- Interns 19&20	4	1	72
Team M- Interns 21&22	4	1	72
Team N- Interns 23&24	4	0	64
Team S- Interns 25&26	4	1	72
Intern T- Intern 27	4	1	72

Table 15: Overtime worked by Anaesthesiology interns in November 2024

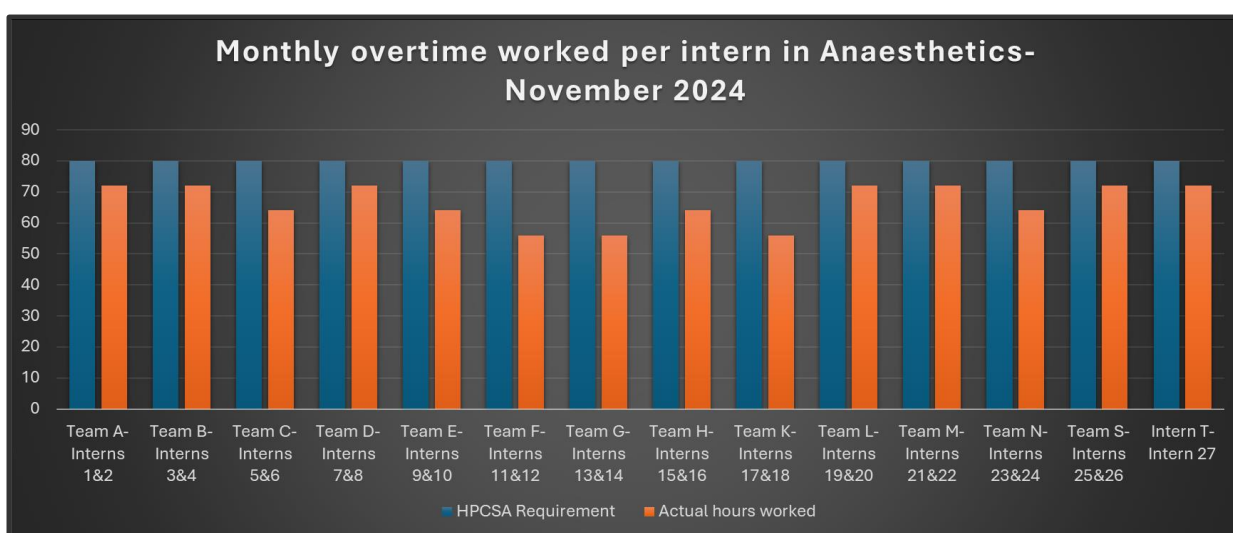


Figure 13: Monthly overtime worked per intern during Anaesthetics

In evaluating compliance with HPCSA concerning monthly overtime, all twenty-seven interns worked less than the 80-hours monthly overtime limit, thus ensuring compliance as illustrated in Figure 13.

In evaluating compliance with continuous shift hours, interns only work 16-hours continuously during a night call which is below the regulated 26-hour continuous shift limit.

In evaluating compliance with HPCSA regulated weekly hours, a simulated work schedule for Team B illustrated in Table 16 was used. The interns worked less than the regulated 60-hours weekly limit during week 1, week 2 and week 3 as shown in

Figure 14. However, it was noted that the maximum weekly overtime worked during week 2 was 32-hours which exceeds the regulated 20-hours weekly overtime limit. During week 4, the interns worked a total of 66,5-hours with 24-hours overtime, which exceeds both the 60-hour and the 20-hour weekly overtime limit, respectively.

Team B: Week 1	Mon 4th (7h30-16h00)	Tues 5th (7h30-16h00)	Wed 6th (7h30-16h00)	Thrs 7th (7h30-16h00)	Fri 8th (7h30-16h00)	Sat 9th	Sun 10th	Total
Hrs	8,5	8,5	8,5	8,5	8,5	0	0	42,5
Team B: Week 2	Mon 11th (7h30-16h00)	Tues 12th (7h30-16h00)	Wed 13th Night Call	Thrs 14th Postcall	Fri 15th (7h30-16h00)	Sat 16th Night Call	Sun 17th	Total
Hrs	8,5	8,5	16	0	8,5	16	0	57,5
Team B: Week 3	Mon 18th (7h30-16h00)	Tues 19th (7h30-16h00)	Wed 20th (7h30-16h00)	Thrs 21st (7h30-16h00)	Fri 22nd (7h30-16h00)	Sat 23rd Day Call	Sun 24th Night Call	Total
Hrs	8,5	8,5	8,5	8,5	8,5	8	16	66,5
Team B: Week 4	Mon 25th Postcall	Tues 26th (7h30-16h00)	Wed 27th (7h30-16h00)	Thrs 28th Night Call	Fri 29th Postcall	Sat 30th	Sun 1st	Total
Hrs	0	8,5	8,5	16	0	0	0	33

Table 16: Simulated weekly work schedule for Team B

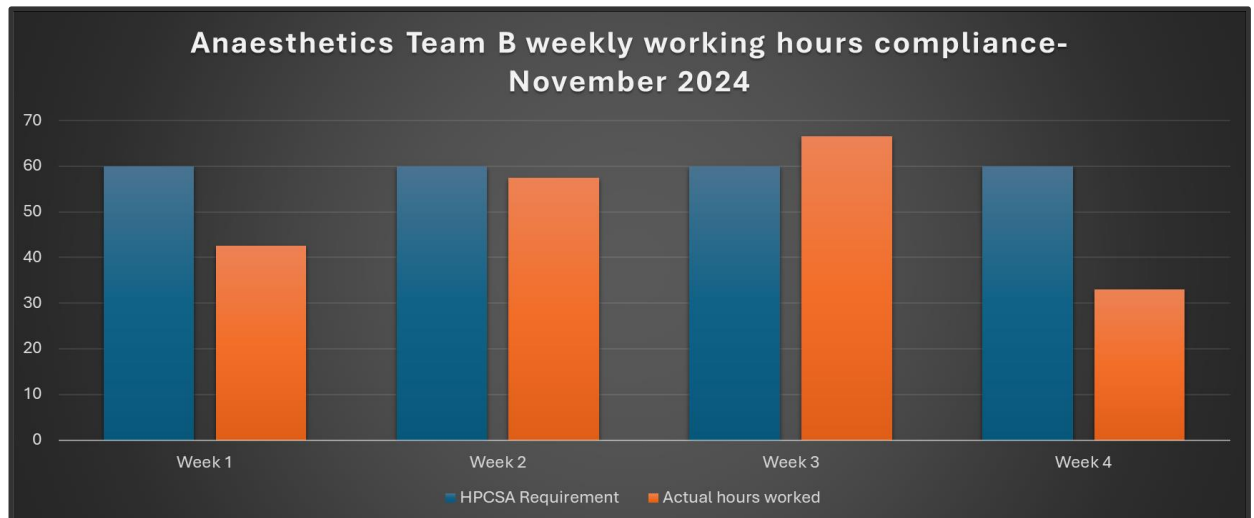


Figure 14: Anaesthetics Team B weekly working hours compliance

In evaluating patient workload, the HPCSA regulations stipulated 15-25 in-patient beds limit. Since the department does not manage in-patients, the easiest analysis of patient workload was based on the information provided. If interns manage to get 100-120 patients signed-off in 2-months, it means 50-60 patients are seen per

month. This amounts to approximately two patients per day, which does not reflect patient overload.

c. Conclusion

The evaluation of the Anaesthesiology department intern work schedule revealed compliance with HPCSA regulations with regards to overtime, continuous working hours, as well as sufficient patient workload. With regards to weekly working hours, most weeks are compliant to the regulated 60-hours weekly limit, however there was poor compliance with ensuring the 20-hours weekly overtime limit was adhered to.

E. FAMILY MEDICINE: EMERGENCY MEDICINE DEPARTMENT - MEU

Some interns rotate through the Medical Emergency Unit (MEU) for 1-month during their Family Medicine rotation in the second year of internship training. The MEU saw the second highest annual patient count of 27018 in 2023 as illustrated in Table 3. This department is also unique in that it manages patients acutely and does not follow-up patients.

a. Description of the work structure

The information was provided by the Head of Department. Interns work 13-hour shifts, with day shifts, abbreviated D13, running from 08h00-21h00 and night shifts (N13) from 20h00-09h00 the following day. Following 2-3 consecutive shifts, the intern will receive 2-3 consecutive days off.

The department has structured the intern shifts to ensure adequate rest, learning, and productivity. Since overtime is not designed for shift work, the department's shift system is calculated to accommodate for 40-hours normal workweek plus only 12-hours weekly overtime. The 52-hours are multiplied by the 4,3-weeks in a month, and a total of 223,6-hours per month should be worked by the intern. The 223,6-hours are divided by the 13-hour shifts, and an intern should be allocated seventeen shifts per month.

b. Critical Analysis of the MEU work schedule

Table 17 illustrates the MEU November 2024 intern work schedule which indicates shift allocations for nine interns. Majority of interns worked 8 D13 shifts and 7 N13 shifts, therefore 15 days on duty and 16 days off. During a shift it was noted that 2-3 interns worked alongside 4-6 MO's and registrars.

	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN	MON	TUES	WED	THUR	FRI	SAT	SUN
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1Dec
Intern1	D13	D13	D13			N13	N13				D13	D13			N13	N13	N13			D13	D13				D13		N13	N13			
Intern2				D13	D13	D13					N13	N13			D13	D13	D13			N13	N13				D13	D13			N13	N13	N13
Intern3				N13	N13			D13	D13	D13			N13	N13				D13	D13		D13	N13	N13				D13	D13			
Intern4				D13	D13			N13	N13	N13			D13	D13				N13	N13		D13				N13	N13			D13	D13	D13
Intern5	D13	D13	D13			N13	N13					D13	D13	N13				D13	D13			N13	N13	N13			D13	N13			
Intern6				D13	D13		N13				D13	D13			N13	N13	N13			D13	N13				N13	N13			D13	D13	D13
Intern7	N13	N13	N13			D13	D13				N13	N13			D13	D13	D13			N13	N13					D13	D13	D13			
Intern8				N13	N13			D13	D13	D13			N13	N13				D13	D13	D13					D13	D13			N13	N13	N13
Intern9	N13	N13	N13			D13	D13				D13		D13	D13				N13	N13			D13	D13	D13			N13	N13			

Table 17: MEU Intern work schedule for November 2024

In evaluating compliance with the HPCSA regulations concerning monthly overtime, it was difficult due to the unique shift system used in this department. However, based on the information provided, only 12-hours per week are calculated as overtime which is below the regulated 20-hours. Also, based on the calculations, interns are meant to be allocated seventeen shifts. However, the work schedule demonstrates that the most an intern worked is fifteen shifts. From a different perspective, if a limit of 60-hours is recommended weekly, it would mean 240-hours a month. Table 18 summarises the total hours worked by each intern from 01 November-30November, and it illustrates that interns worked 182-hours and 195-hours, which is less than the 240-hours monthly limit as shown in Figure 15.

Intern	D13 (08h00-21h00)	D13 Total hours worked	N13 (20h00-09h00)	N13 Total hours worked	Total hours worked
Intern 1	8	104	7	91	195
Intern 2	8	104	6	78	182
Intern 3	8	104	7	91	195
Intern 4	7	91	7	91	182
Intern 5	8	104	7	91	195
Intern 6	7	91	7	91	182
Intern 7	8	104	7	91	195
Intern 8	8	104	6	78	182
Intern 9	8	104	7	91	195
Total	70	910	61	793	1703

Table 18: Total hours worked by MEU interns in November 2024

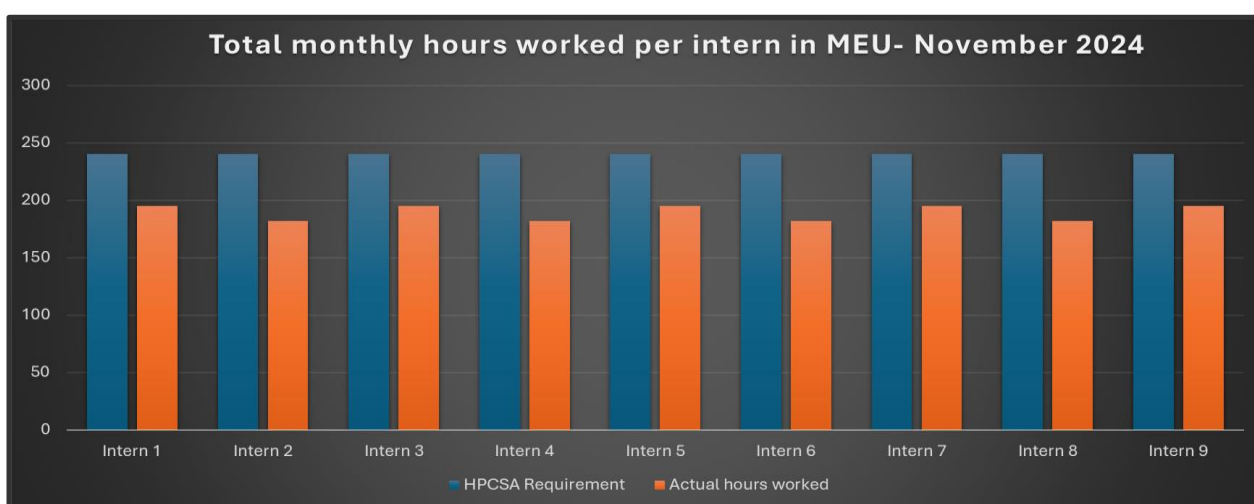


Figure 15: Total hours worked per intern during MEU rotation in November 2024

In evaluating compliance with continuous shift hours, the shifts only allow for 13-hours continuous work which is below the recommended 26-hours.

In evaluating compliance regarding weekly working hours, Table 17 illustrates that for 3 weeks, on average, the intern can work 2-3 shifts which equate to 26-39 hours weekly which is below the regulated 60-hours weekly limit. However, during the week that includes the weekend shift, the intern works 5-6 shifts, which amounts to 65-78 hours, thus exceeding the 60-hours weekly limit. Figure 16 below illustrates the weekly working hours for Intern 2 from Monday 4th November until Sunday 1st December 2024 indicating compliance during week 1 (39-hours) and 3 (26-hours),

and non-compliance during weeks 2 and 4 as they worked 65-hours which is above the recommended 60-hour limit.

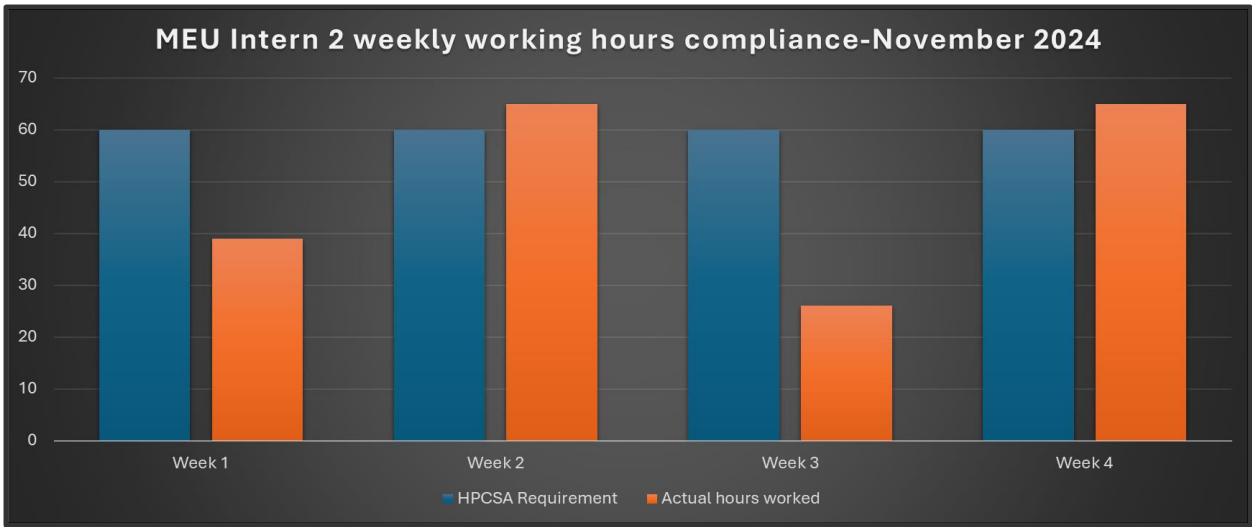


Figure 16: Intern 2 weekly working hours compliance

In evaluating patient workload, it is important to note that the department is not heavily dependent on interns to manage all the patients, but the workload is distributed among approximately 6-9 doctors during a shift, of which 2-3 are interns. In a department that saw a total of 27018 patients in 2023, it means approximately 2252 patients per month, and seventy-five patients daily. If those seventy-five patients are distributed among the 6-9 doctors, each intern would see approximately 8-12 patients during a 13-hour shift.

c. Conclusion

The evaluation of the MEU department intern work schedule revealed compliance with HPCSA regulations with regards to monthly working hours, continuous working hours, as well as sufficient patient workload. It is important to highlight that HPCSA overtime compliance was not assessed, as the department follows a shift-based work structure. Instead, the focus was on evaluating monthly working hours. With regards to weekly working hours, most weeks were compliant, however the week which includes weekend shift was non-compliant as it exceeded the 60-hour weekly limit.

4.2.3 Number of interns required to achieve compliance with HPCSA regulations

Following the evaluation of the five specialty domains for compliance with HPCSA regulations, the next step is to assess the number of interns that would be required to achieve compliance and therefore result in efficient work schedules in those departments. Only the rotations which were non-compliant with HPCSA monthly overtime regulations were evaluated, namely, General Medicine, Obstetrics and Gynaecology, and General Surgery.

For the General Medicine department, Table 19 below was used to calculate the number of interns required by referring to Table 5 which shows the total overtime worked by seven interns in the one unit evaluated. Table 19 illustrates that the seven interns exceeded the 80-hours monthly overtime limit by 190-hours. Approximately two additional interns are required in the unit to cover the extra 190-hours overtime. Therefore, for all five units, it means an additional twelve interns are required in the department. This means a total of forty-seven interns should be allocated during General Medicine rotation to comply with HPCSA monthly overtime regulations.

	Total hours worked on calls	Hours in excess of the regulated 80 hours overtime
Intern 1	120	40
Intern 2	105	25
Intern 3	90	10
Intern 4	90	10
Intern 5	105	25
Intern 6	120	40
Intern 7	120	40
Total	750	190
Number of interns required to work the excess overtime in one unit (190/80)		2,375
Number of interns required in all the 5 units		11,875

Table 19: The number of interns required in General Medicine

For Obstetrics and Gynaecology department, Table 20 was used to calculate the excess overtime hours worked during the Obstetrics rotation by referring to Table 8. Table 20 illustrates that a total of 141,5-hours excess overtime were worked by all the five units in the department. Therefore, two additional units would be required to cover the 141,5-hours overtime. Given that twenty-six interns are

allocated during Obstetrics rotation, with an average of five interns per unit, an additional ten interns would be required in the department. Therefore, a total of thirty-six interns must be allocated during Obstetrics rotation to ensure compliance with HPCSA overtime regulations.

	Total hours on call	Hours in excess of the regulated 80 hours overtime
Unit A	110	30
Unit B	110	30
Unit C	110	30
Unit D	110	30
Unit E	101,5	21,5
Total	541,5	141,5
Number of additional units required to work the excess overtime in the department (141,5/80)		1,76875

Table 20: Number of additional Obstetrics units required

For the Gynaecology rotation, Table 21 illustrates that all five units each worked 64-hours above the regulated 80-hour monthly overtime limit. A total of 320-hours excess overtime would need to be covered by an additional four units. Given that each unit is allocated two interns, it means an additional eight interns would be required in the department. Therefore, a total of eighteen interns need to be allocated during the Gynaecology rotation to ensure compliance with HPCSA monthly overtime regulations.

	Total hours on call : (08h00-08h00) =24hrs	Hours in excess of the regulated 80 hours overtime
Unit A	144	64
Unit B	144	64
Unit C	144	64
Unit D	144	64
Unit E	144	64
Total	720	320
Number of additional units required to work the excess overtime in the department (320/80)		4

Table 21: Number of additional Gynaecology units required

In the Obstetrics and Gynaecology department, calculations indicate that an additional eighteen interns are required, ten during Obstetrics and eight during Gynaecology rotation, bringing the total to fifty-four interns to ensure compliance with HPCSA overtime regulations.

For the General Surgery department, Table 22 outlines the required number of interns to achieve compliance with the 80-hours overtime limit. In November 2024, the total overtime worked by thirty-five interns amounted to 5 088-hours as illustrated in Table 12. However, if interns can only work 80-hours overtime, it means only 2800-hours of the 5088-hours can be covered by the thirty-five interns. This leaves 2288-hours excess overtime which would require approximately twenty-nine additional interns. Therefore, a total of sixty-four interns are required during the General Surgery rotation to ensure compliance with the regulated HPCSA overtime limit.

Total hours required to cover overtime per month	5088
Total hours to be covered by 35 interns if each worked 80 hours overtime	2800
Excess overtime hours needing to be covered	2288
Number of interns required to cover excess overtime hours if they worked 80 hours	28,6

Table 22: Total number of interns required in General Surgery

Conclusion

An evaluation of the three busiest CHBAH first year intern rotations revealed that there is a shortage of interns in those departments which has resulted in non-compliance with HPCSA overtime regulations and currently inefficient work schedules. To ensure efficient work schedules compliant with the HPCSA regulations, a total of forty-seven interns need to be allocated during General Medicine, fifty-four during Obstetrics and Gynaecology, and sixty-four interns during General Surgery rotations.

4.3 Summary of analysis

ChatGPT 4.0 is the Generative AI model trained on HPCSA regulations and utilised in this study to develop a compliant ideal generic work schedule for interns. The training of ChatGPT exposed several errors generated by the model, however these were corrected with further iterations and prompts, and quality assurance was also ensured.

Thereafter, the November 2024 intern work schedules from the five busiest specialty domains at CHBAH were evaluated, namely, General Medicine, Obstetrics and Gynaecology, General Surgery, Anaesthesiology, and Family Medicine MEU. Each department has a unique work structure, and compliance to four HPCSA regulations with regards to monthly overtime, continuous shift working hours, weekly working hours, and patient workload was evaluated. Poor compliance to monthly overtime was assessed to be a problem in the three first year rotations, namely, General Medicine, Obstetrics and Gynaecology, and General Surgery. Continuous shift working hours exceeded the HPCSA regulated limit in General Surgery and Gynaecology rotations. Poor compliance to weekly working hours was observed in all the five departments, however, all the five departments ensured reasonable patient workload for interns to manage. This assessment indicates that CHBAH intern work schedules are inefficient as interns are subjected to long working hours unregulated by HPCSA, therefore increasing their risk of fatigue and burnout, and compromising on their wellbeing, learning experience, as well as the quality of patient care they offer.

To account for the excess overtime hours and ensure compliance with HPCSA regulations during the General Medicine, Obstetrics and Gynaecology and General Surgery rotations, it was established that additional interns are required. A total of forty-seven interns during General Medicine, fifty-four during Obstetrics and Gynaecology, and sixty-four during General Surgery rotations would ensure compliance with HPCSA regulations and for efficient work schedules to be developed.

CHAPTER 5. RECOMMENDATIONS AND CONCLUSION

5.1 Recommendations

With a total of forty-seven interns required during the General Medicine rotation to establish an efficient work schedule compliant with HPCSA regulations, it would be ideal to have two additional units to accommodate the twelve additional interns to the current work structure. This will result in a 7-day intake cycle and therefore reduce Intake call hours from 90-hours to 75/60-hours to also accommodate for Ward calls as illustrated in Table 23. Duration of calls will also need to be amended to ensure the monthly overtime is capped at 80-hours and 20-hour weekly limits as regulated by HPCSA. The disadvantage of establishing additional units, is the high labour cost of R47 331 276, 00 per year for 12 additional consultants, registrars, and interns as illustrated in Table 24.

	Total # of interns	Total Intake Calls	Total hours on Intake calls
Unit 1	7	5	75
Unit 2	7	5	75
Unit 3	7	4	60
Unit 4	7	4	60
Unit 5	7	4	60
Unit 6	6	4	60
Unit 7	6	4	60
Total	47	30	450

Table 23: Recommended allocation of additional interns during General Medicine rotation

Hiring budget estimate for two additional units in the General Medicine Department			
Medical Doctor	Number required per unit	Gross Salary per Dr	Total Cost
Interns	6	R850 780,00	R5 104 680,00
Registrars	6	R1 374 158,00	R8 244 948,00
Consultants	6	R1 719 335,00	R10 316 010,00
Total cost per unit			R23 665 638,00
Total cost for two additional units			R47 331 276,00

Table 24: Hiring budget for two additional units in the General Medicine Department (*Gross salary scales obtained from HR CHBAH-2025).

To create an efficient work schedule compliant with HPCSA overtime regulations for the Obstetrics rotation, while preserving the current work structure, two additional units will need to be introduced. This will ensure all seven units are allocated less than 80-hours overtime as illustrated Table 25. However, for units A-D working two weekend calls a month, the weekly 20-hour overtime limit may be exceeded if both 15,5-hour plus 8,5-hour calls are worked within the same week, resulting in 24-hours weekly overtime. Therefore, call durations may need adjusted accordingly to ensure regulatory compliance.

	# of Interns	# of calls per unit (16h00-07h30) =15,5hrs	# of weekend day calls (07h30-16h00) =8,5hrs	Total monthly overtime
Unit A	6	4	2	79
Unit B	5	4	2	79
Unit C	5	4	2	79
Unit D	5	4	2	79
Unit E	5	4	1	70,5
Unit F	5	5	0	77,5
Unit G	5	5	0	77,5
Total	36	30	9	541,5

Table 25: Recommended call allocation for the seven units during Obstetrics rotation

For the Gynaecology rotation, introducing an additional four units to accommodate the eight additional interns would be highly challenging. Table 26 outlines a recommended allocation of these interns within the existing work structure. To comply with the regulated weekly overtime limits, call durations should be reduced to 20-hours. Units with four interns will have two interns paired for calls, thus

ensuring each intern works within the 80-hours overtime limit. Units with three interns will require all three interns to work all four calls together.

	# of Interns	# of calls per unit	Total hours on call : (12h00-08h00) =20hrs
Unit A	4	8	160
Unit B	4	7	140
Unit C	4	7	140
Unit D	3	4	80
Unit E	3	4	80
Total	18	30	600

Table 26: Recommended call allocation accommodating additional Gynaecology interns

The General Surgery rotation requires an additional twenty-nine interns to comply with HPCSA overtime regulations. Since the interns do not work calls in units, the twenty-nine interns can be easily integrated into the call roster. However, call durations should be reduced to 20-hours, with each intern working a maximum of four calls per month. In addition to that, interns could rotate monthly through the two busiest units, which are Trauma and AC Units, rather than remaining in a single unit for the entire 3-month rotation. This will not only optimise workload distribution, but it will also enhance learning by providing interns with broader surgical exposure. Table 27 illustrates an example of the 3-month rotation schedule for November 2024 interns.

UNIT	Month 1	Month 2	Month 3
TRAUMA UNIT	Trauma 1	AC 1	Unit 4-1
TRAUMA UNIT	Trauma 2	AC 2	Unit 4-2
TRAUMA UNIT	Trauma 3	AC 3	Unit 4-3
TRAUMA UNIT	Trauma 4	AC 4	Unit 5-1
TRAUMA UNIT	Trauma 5	AC 5	Unit 5-2
TRAUMA UNIT	Trauma 6	AC 6	Unit 5-3
TRAUMA UNIT	Trauma 7	AC 7	Burns 1
TRAUMA UNIT	Trauma 8	AC 8	Burns 2
TRAUMA UNIT	Trauma 9	Unit 1-1	Vascular 1
AC UNIT	AC 1	Unit 1-2	Vascular 2
AC UNIT	AC 2	Unit 1-3	Trauma 1
AC UNIT	AC 3	Unit 1-4	Trauma 2
AC UNIT	AC 4	Unit 1-5	Trauma 3
AC UNIT	AC 5	Unit 3-1	Trauma 4
AC UNIT	AC 6	Unit 3-2	Trauma 5
AC UNIT	AC 7	Unit 3-3	Trauma 6
AC UNIT	AC 8	Unit 3-4	Trauma 7
UNIT 1	Unit 1-1	Unit 4-1	Trauma 8
UNIT 1	Unit 1-2	Unit 4-2	Trauma 9
UNIT 1	Unit 1-3	Unit 4-3	Unit 3-1
UNIT 1	Unit 1-4	Unit 5-1	Unit 3-2
UNIT 1	Unit 1-5	Unit 5-2	Unit 3-3
UNIT 3	Unit 3-1	Unit 5-3	AC 1
UNIT 3	Unit 3-2	Burns 1	AC 2
UNIT 3	Unit 3-3	Burns 2	AC 3
UNIT 3	Unit 3-4	Vascular 1	AC 4
UNIT 4	Unit 4-1	Vascular 2	AC 5
UNIT 4	Unit 4-2	Trauma 1	AC 6
UNIT 4	Unit 4-3	Trauma 2	AC 7
UNIT 5	Unit 5-1	Trauma 3	AC 8
UNIT 5	Unit 5-2	Trauma 4	Unit 1-1
UNIT 5	Unit 5-3	Trauma 5	Unit 1-2
BURNS UNIT	Burns 1	Trauma 6	Unit 1-3
BURNS UNIT	Burns 2	Trauma 7	Unit 1-4
VASCULAR UNIT	Vascular 1	Trauma 8	Unit 1-5
VASCULAR UNIT	Vascular 2	Trauma 9	Unit 3-4

Table 27: General Surgery 3 months rotation allocation

For the Anaesthesiology department, a balance of the weekly working hours is recommended to ensure compliance with the maximum 60-hour week and the 20-hour weekly overtime limits. This can be achieved by allocating interns one 16-hour call weekly.

To ensure an efficient work schedule for the MEU during Family Medicine rotation, an evenly distributed allocation of shifts is recommended. Interns scheduled for weekend shifts should be allocated only two weekday shifts, ensuring a maximum of four shifts per week. This results in a total of 52-hours per week, which is within the 60-hours weekly limit.

Creating efficient intern work schedules compliant with HPCSA regulations is a complex and time-consuming process, highlighting the need for Generative AI as an effective administrative tool to simplify complex tasks at speed (Khanzode &

Sarode, 2020). The code generated after training ChatGPT 4.0 is aimed to create an efficient intern work schedule for CHBAH interns aligning with both HPCSA regulations and the department's unique work structure. Additional prompts will be required to account for the work structure and all the interns during the rotation, ensuring appropriate monthly allocation while adhering to all conditions provided.

5.2 Conclusion

Medical internship training is a challenging two-year period for newly qualified doctors and is associated with a high risk of fatigue and burnout mainly due to long working hours, negatively impacting the interns' wellbeing, learning experience, and quality of patient care (Gunasingam et al., 2015). The HPCSA serves as the regulatory body overseeing internship training and sets regulations for training institutions to comply with. However, these regulations are not aligned with international standards and recommendations in the empirical literature regarding working hours.

Despite this misalignment, this study found that the actual working hours on the work schedules for CHBAH interns during the General Medicine, Obstetrics and Gynaecology, and General surgery rotations were still non-compliant with HPCSA regulations. This raises concerns of possible fatigue and burnout among interns at CHBAH during these rotations, and the subsequent negative impact on their wellbeing, learning, and patient care quality.

The objective of this study is to develop an efficient work schedule for CHBAH interns compliant with HPCSA regulations, ultimately contributing to reduced burnout, enhanced intern well-being, improved learning experience and potentially improved patient care quality. To achieve this, additional interns will be required during the General Medicine, Obstetrics and Gynaecology, and General Surgery rotations. Furthermore, Generative AI will be used to create efficient work schedules for all rotations by streamlining the complex and time-consuming task of ensuring compliance with all HPCSA regulations regarding intern working conditions.

Generative AI is widely used in different industries to reduce the administrative burden and ensure complex tasks are achieved speedily and accurately (Khanzode

& Sarode, 2020). ChatGPT 4.0 was used in this study and the model was trained to fully account for the HPCSA regulations. Consistency, relevance and reliability was evaluated as recommended by Prieto et al. (2023) for quality assurance (Prieto et al., 2023). This required additional prompts and training which corrected for the mistakes. Following the training, the ideal generic intern work schedule was created and coded to provide the schedule in Excel format. The code generated can be used to create an efficient intern schedule for CHBAH interns for each rotation, adhering to both the HPCSA regulations and the department's unique work structure. The final schedule of all the departments evaluated at CHBAH was unfortunately not provided due to limited time constraints, and this can be explored for future research. By achieving an efficient work schedule compliant with HPCSA regulations, interns at CHBAH will experience less risk of fatigue and burnout, and therefore enhanced intern well-being, improved learning experience and potentially improved patient care quality. This objective can be evaluated for future research to assess confirm the correlation.

Maoz (2023) reiterated the importance of considering workload, and not only number of interns, when developing interventions to reduce working hours (Maoz Breuer et al., 2023). This study revealed compliance with regards to patient workload in all specialty domains evaluated. Therefore, increasing the number of interns in the three first year rotations to ensure compliance with HPCSA working hour regulations, may inadvertently impact on intern learning experience. Therefore, a balance between working hours and workload is required without compromising intern training experience.

The issue of fatigue and burnout among medical interns is complex and requires a multifaceted strategy. This study only focuses on the administrative incorporation of technology in creating an efficient intern work schedule for CHBAH interns compliant with HPCSA regulations. However, using technology to create an efficient work schedule will ensure compliance on paper, but it would be difficult to assess whether the work schedule is adhered to and whether it is effective in reducing fatigue and burnout. Therefore, implementing the work schedule in isolation may not be optimal and may require integration with additional technology-driven control measures. This may include administrative control measures such as electronic time-recording

systems to objectively monitor and measure working hours (Erasmus, 2012), as well as technology-based Personal Protective Equipment such as colour coded armbands signalling fatigue (Kotze et al., 2020).

Generative AI has quickly gained widespread recognition across various industries and continues to evolve rapidly. As a result, future research should explore additional ways to utilize this technology to mitigate fatigue and burnout during medical internship training, ultimately enhancing intern well-being, learning experience, and the quality of patient care provided.

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APPENDIX

a. Excel code of the Ideal generic work schedule created by ChatGPT4.0:

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Patients	Weekly Hours
Week 1	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-16:00 (6 patients)	07:00-08:00 (Ward round), 08:00-12:00 (5 patients), Call: 16:00–07:00 (22 patients incl. meal breaks)	Post-call ward round (07:00–09:00), Off	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-16:00 (6 patients)	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-15:00 (6 patients), 15:00-16:00 (Tutorial)	Call: 07:00–19:00 (24 patients incl. meal breaks)	Post-call ward round (07:00–10:00), Off	99	60
Week 2	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-16:00 (6 patients)	07:00-08:00 (Ward round), 08:00-12:00 (5 patients), Call: 16:00–07:00 (22 patients incl. meal breaks)	Post-call ward round (07:00–09:00), Off	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-16:00 (6 patients)	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-15:00 (6 patients), 15:00-16:00 (Tutorial)	Call: 07:00–19:00 (24 patients incl. meal breaks)	Post-call ward round (07:00–10:00), Off	99	60
Week 3	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-19:00 (6 patients)	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-16:00 (6 patients)	07:00-12:00 (5 patients), Call: 16:00–07:00 (22 patients incl. meal breaks)	Post-call ward round (07:00–09:00), Off	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-19:00 (6 patients), 15:00-16:00 (Tutorial)	Off (Free weekend)	Off (Free weekend)	99	60
Week 4	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-16:00 (6 patients)	07:00-08:00 (Ward round), 08:00-12:00 (5 patients), Call: 16:00–07:00 (22 patients incl. meal breaks)	Post-call ward round (07:00–09:00), Off	07:00-08:00 (Ward round), 08:00-12:00 (8 patients), 13:00-16:00 (6 patients)	07:00-08:00 (Ward round),				

08:00-12:00 (8 patients), 13:00-15:00 (6 patients), 15:00-16:00
(Tutorial)Call: 07:00–19:00 (24 patients incl. meal breaks) Post-call
ward round (07:00–10:00), Off 99 60