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Peer-to-Peer Mentoring and Medication Errors among Pharmacists in Sri Lanka: Mediating role of Workload Stress

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Abstract

This study assesses the impact of peer-to-peer mentoring projects (PMPs) on medication errors in Sri Lanka's government hospitals, specifically investigating the mediating role of workload stress. A cross-sectional design was employed, collecting online survey data from 384 purposively selected pharmacists regarding PMP usage, workload stress, and self-reported dispensing errors. Data analysis included confirmatory factor analysis and a two-step modelling approach using SmartPLS. Findings reveal significant negative correlations between PMPs and medication errors ($\beta = 0.42$, $p < 0.01$) and between PMPs and workload stress ($\beta = 0.51$, $p < 0.01$). Additionally, workload stress was positively related to errors ($\beta = 0.38$, $p < 0.01$) and partially mediated the PMP-error relationship ($\beta = 0.194$, $p < 0.001$), suggesting that error reduction is effectively achieved by alleviating pharmacist stress. Consequently, this study offers guidance for healthcare managers and policymakers to implement PMPs, fostering supportive environments for knowledge sharing, skill development, and emotional support to empower pharmacists to cope with demanding workloads and enhance patient safety. Future research should employ longitudinal and qualitative methods to explore long-term mechanisms.

Keywords: *Medication errors; Workload stress; Peer-to-peer mentoring programs; Sri Lankan government hospitals; Patient safety*

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Introduction

Medication errors are a significant threat in medical circles everywhere. Pharmacists are on the front line of patient safety. In the government hospitals of Sri Lanka, pharmacists face significant challenges, including staffing shortages, long hours, and limited resources. Under these converging circumstances, workload stress is a significant factor that can undermine cognitive performance and substantially increase the risk of medication errors. These errors can have catastrophic consequences, prompting a crucial question: How can pharmacists be better equipped with the tools and support needed to mitigate this omnipresent threat? While technological solutions and individual-level interventions like mindfulness training are being explored, they often ignore the critical social and emotional dimensions essential for pharmacist well-being and medication safety (Melnyk et al., 2023). This study investigates an under-researched area: the role of peer-to-peer mentoring programs (PMPs) in mitigating medical errors among pharmacists in Sri Lanka's government hospitals.

Peer-to-peer mentoring programs (PMPs) provide a unique opportunity to draw on social support and everyday experience to support pharmacists (Goff et al., 2021). These programs function as a network where seasoned pharmacists are matched with junior colleagues, creating a supportive place for mutual help and learning. This type of mentorship may serve as a buffer, helping pharmacists endure the stress of overworked hospital environments. Benefits of such mentorship include increased job satisfaction, enhanced professional skills, and reduced workload stress. However, as Desselle et al. (2021) noted, a key question is what resources are needed to implement these programs effectively for already overburdened pharmacists.

Theoretically, this study is grounded in the Job Demands-Resources (JD-R) model (e.g., Bakker & Demerouti, 2017; Demerouti et al., 2001). In this framework, high workload (a 'demand') leads to negative outcomes like stress and errors. PMPs can act as a critical 'social resource,' buffering the negative impact of these demands and helping employees cope, which provides a clear theoretical rationale for the proposed mediating relationship. Meanwhile, mentorship programs can foster a more positive work environment and help alleviate the pressure on individual pharmacists, enabling them to concentrate on their work with more focus. By providing a sense of belonging, facilitating peer-to-peer learning, and sharing challenges within a supportive network, PMPs can enhance focus and reduce stress (cf. Desselle, 2021).

To address the gap in the literature regarding the effectiveness of PMPs in the Sri Lankan pharmacy context, this study investigates two primary research questions. The first is: "What is the relationship between Peer-to-Peer Mentoring Programs and Medication Errors of Pharmacists in Government Hospitals in Sri Lanka?" The second is: "How does Workload Stress mediate the relationship between Peer-to-Peer Mentoring Programs and Medication Errors of Pharmacists in Government Hospitals in Sri Lanka?"

The findings of this research are expected to have significant practical and theoretical implications.

Theoretically, this study will add to the understanding of the complex relationship between pharmacist well-being, social support systems, and medication safety within the JD-R framework. Practically, the results will provide valuable guidance for governments and healthcare managers seeking successful, low-cost intervention efforts. By demonstrating the value of PMPs, this research can help empower pharmacists, build a supportive work environment, and ultimately protect patient lives in Sri Lankan government hospitals. This study, therefore, investigates how peer-to-peer mentoring programs impact medication errors, with workload stress as a mediating factor among pharmacists in Sri Lankan government hospitals.

Literature Review

Medication Errors in Hospitals

While patient safety should be healthcare's top priority, medication errors continue to pose a persistent challenge. This is especially true in hospitals, where complex medication regimens mix with high patient volumes (Pedersen, 2017). The World Health Organization has pragmatically put forward an estimate of several million instances of preventable harm due to medication errors each year (Al-Worafi, 2020). This underscores the need for urgent attention to the problem. So, researchers present this survey of peer-to-peer mentoring programs (PMPs) in government hospitals for all pharmacists of Sri Lanka. This review, specifically, looks at the potential role of peer-to-peer mentoring programs (PMPs) in mitigating medication errors among pharmacists in Sri Lankan government hospitals. Beginning by establishing the global context of medication errors, researchers see them as a widespread healthcare challenge affecting patients in various settings.

According to the World Health Organization (WHO), bitter evidence shows that as many as one in four adverse occurrences arising in hospitals are due to medication mistakes. Factors at play include intricate medication systems, poor communication, and the burden of workload stress on healthcare professionals (World Health Organization, 2021). Unfortunately, Sri Lanka has a medication error rate higher than the world average (Samaranayake, 2016), worsening its acute distress situation. Unique to the Sri Lankan healthcare system, this higher rate can be blamed on many things. In Sri Lanka, a South Asian Island, chronic disease prevails. With a comparably few experts and specialised pharmaceuticals to help them, the country's medical system places excellent strain on pharmacists in managing complex medication regimens. For example, as Dayasiri, Jayamanne, and Jayasinghe (2020) explain, the absence of standardised medication management systems and resources for continuous training can exacerbate the risk of making drug mistakes.

Furthermore, suppose Researchers dig deeper into the Sri Lankan experience. In that case, one of the reasons why researchers should explore PMPs is because they often reinforce existing social conventions. Sri Lanka is a low-income country with poor health care and a high prevalence of chronic diseases. This is just the right environment for mistakes to occur in medication administration. Some of the

essential findings of surveys among Sri Lankan hospital pharmacists are inextricably linked with modern pharmacology. Many pharmacists find their workloads oppressive and feel they need to be more capable of addressing the needs of patients (Bradley et al., 2024; Wardani et al., 2023). This indicates that measures to ease the work stress and lend additional support to pharmacists could go a long way in reducing medication errors. On the other hand, a balanced view requires acknowledging potential drawbacks of PMPs. Some criticisms cite resource allocation issues, the potential for power imbalances between mentor and mentee, and limited strong evidence of their effectiveness in reducing medication errors among pharmacists (Gillani et al., 2021). While these criticisms exist, the possible advantages of (PMPs) in knowledge sharing, promoting best practices, and creating a safety-minded culture in pharmacy settings should also be further studied.

Workload Stress of Pharmacist

Medication errors, which can damage patients, are all too frequently seen in healthcare systems worldwide (Ghezaywi et al., 2024). Pharmacists manage a complex series of drug plans and are so often misinformed that they cannot help feeling overwhelmed. Given their heavy workloads and challenging environments, pharmacists are susceptible to errors. A comprehensive understanding of how pharmacists' workload stress interacts with medication errors is indispensable in such a context. This review discusses the globe's impact in terms of workload stress on pharmacists specifically-, as well as how it might lead to medication errors. It concludes by examining work conditions in Sri Lanka that bear upon this vital issue. Pharmacists everywhere are under significant stress. Long hours, complex medication systems, and limited resources create a significant workload strain (Eden et al., 2009). This tension can be present in burnout, reduced job satisfaction, and diminished cognitive capacity and attention to detail (Eden et al., 2009). Studies have established a clear link between increased workload stress and medication errors, highlighting the damaging impact on patient safety (Di Muzio et al., 2019). Under pressure, pharmacists are far more likely to make mistakes in dispensing, documenting information or interacting with those under their care and the other healthcare providers.

In the Sri Lankan healthcare environment, these pressures are particularly pronounced. A large number of people suffer from chronic disease together with poor treatment options and specialists, thus burdening pharmacists with complex regimens of drugs to manage. Their strain could be immense (Thirumagal et al., 2017). On the other hand, Sri Lankan studies have shown that pharmacists are under too much stress from workload, poor staffing, and too little training. (Thekkur et al., 2022). This indicates that there might need to be more people to avoid basic errors in Sri Lankan government hospitals. There have been discrepancies in Al-Ahmadi and others' findings on the relationship between pharmacist strain and medication errors (Al-Ahmadi et al., 2020). Researchers need to explore the specific mechanisms by which This leaves gaps and new questions about how to reduce stress for pharmacists. Should one arise, more needs to be known about counteracting the effects of pharmacists' workload stress to avoid

medication errors. In the context of a healthcare system under minimal but natural pressures, the special conditions of Sri Lanka provide an excellent stage for viewing these research gaps. Correction of drug errors is efficient and practical in light of this comprehensive study/research data. This new work strengthens the amiable relationship between pharmacists and their customers. Ultimately, it makes for a healthier, safer, hands-on way of health care that wants good performance and results. Living in a world where everyone bears the burdens of life, rather than only being "no more than painted," is a positive society.

Thus, the considerable overwork pharmacists face in many countries is related to medication safety in ways that cannot be ignored. In the Sri Lankan context, there are unique obstacles. Nonetheless, Researchers have an incredible chance to deepen their understanding of this issue and to tailor interventions that can protect patients and improve the effectiveness of the healthcare system. If researchers can tie up these loose ends in research and focus on evidence-based intervention, then one day, there will be a world in which errors from medication are kept to a minimum, and pharmacists get the support they deserve to work.

Peer-to-Peer Mentoring Programs in Healthcare

With the bugbear of healthcare systems worldwide, medication errors threaten patient safety and come with hefty costs. Since they are the custodians of many complex drug therapies, pharmacists are vulnerable to these mistakes. They absorb large amounts of work and have little support. In such a context, peer mentoring becomes a promising intervention, benefiting the trainee and the healthcare system. This review article examines the complex relationship between PMPs, job stress, and medication errors. The focus is on pharmacists in Sri Lankan national hospitals. Medication errors extend beyond international borders worldwide, affecting healthcare systems in many forms. According to the World Health Organization's estimation, a quarter of hospital adverse events are due to medication errors, underlining an urgent need for specific remedies (World Health Organization, 2014). Making the situation worse, Kable, Chenoweth, Pond and Hullick (2015) emphasise that complex medication systems, inadequate communication, and the stresses of medical professionals combine to multiply problems.

Contemporary efforts to encourage global standardisation of drug usage procedures and communications are at odds with these various needs, particularly for interventions suited to individual weaknesses (Hebbar et al., 2018). Similarly, A significant feature of the healthcare situation in Sri Lanka is the problem of safely taking medicines. According to Sakeena, Bennett, and McLachlan (2019), with many chronic diseases and scarce access to specialist clinics and specific medications, the pharmacist is under tremendous pressure to manage complex lines of treatment. In addition, limited resources and an inadequate network for continuous training increase the chances of making mistakes. Pharmacists in Sri Lanka have high levels of work pressure and a high level of job burnout, leading them, in turn, to reduce their ability to use medicine and its dosage treatment

correctly (Anjalee et al., 2021). This is a complex situation, but PMPs can provide a supportive solution. PMPs promote knowledge sharing, mentorship, and emotional support by pairing experienced pharmacists with younger colleagues. Studies have also suggested that PMPs could be linked to increased job satisfaction, confidence, and healthier clinical skills (Lyles et al., 2021). This is not just a benefit for the individual, though: surveys suggest that PMPs can help lower medication errors in nursing settings (Griffiths et al., 2018). Though research on PMPs for Sri Lankan pharmacists is scarce, the available evidence from other healthcare professionals and worldwide concerning trends suggests considerable promise for them. These PMPs can be considered an environment that fosters the exchange of knowledge, helps pharmacists improve their skills and gives them the confidence to deal with complicated medication regimens and manage excessive workloads. This could reduce medication errors and make the patient care process safer (Ranasinghe et al., 2023).

Nevertheless, the intimate connections between PMPs, workload stress and medication errors within the context of Sri Lankan pharmacists represent a vastly uncharted frontier (Hill & Abhayasinghe, 2022). PMPs have research gaps because their exact mechanisms for how nurses' workload causes stress and more mistakes with their medications are unknown. These issues must also be addressed to learn what may be necessary in the Sri Lankan health care system: the contextual factors determining PMP effectiveness. There must be appropriate PMPs for the pharmacists of Sri Lanka if Researchers are to keep the medication in government hospitals safe. Medication errors are still a global problem, especially for pharmacists. The potential for Professional Development was seen in PMPs, and this, of course, favours researchers. By addressing these research gaps, researchers can work to find the optimal PMPs for the specific problems the country's pharmacists face. Now, there is a healthcare system in which medication safety is ensured.

Peer-to-Peer Mentoring Programs and Medication Errors

A persistent concern in healthcare systems worldwide, leading to potentially disastrous consequences, is the problem of medication errors (Worafi, 2020). Pharmacists, often tasked with managing complex drug schedules and spending much of their time labouring under an overloaded work output, are particularly vulnerable to making such errors (Giannetta et al., 2022). In this light, Peer-to-Peer Programs (PMPs), which provide pharmacists with an immersive experience and full support, are an encouraging new type of intervention. They help pharmacists develop necessary abilities and support in encounters with patients who are demanding and complicated by training while also potentially lowering the chances they might make errors. This review takes a deeper dive into PMP's potential role among pharmacists in reducing medication errors and focuses on how the subtle exchange between mentors and interns interacts with onerous workloads to affect patient safety.

Research suggests that PMPs can empower mentees with enhanced clinical skills, increased confidence,

and improved job satisfaction. As shown in empirical studies, mentoring relationships mitigate medication errors by numerous means (Lyles et al., 2021). Specifically, there is a positive correlation between PMPs and reduced medication errors in nursing environments. Some studies have shown that peer mentoring programs play a role in reducing medication errors (Lake, 2016). Research on pharmacist medication errors and PMPs is limited. However, what evidence exists from other healthcare professionals and the theoretical base of mentoring could suggest their potential impact in this domain (Giannetta 2022). PMPs can reduce medication errors in multiple ways: It was argued that PMPs could be used to organise support. By creating a conducive milieu for exchanging knowledge and practising skills, mentors can equip pharmacists with the knowledge necessary to manage complex medication regimens and understand the best approaches to maintaining medication safety. PMPs also offer emotional support and stress management methods to cope with workload stresses, potentially offsetting the effects of strain on cognitive performance and attention to detail - both of which are necessary to prevent medication errors Sri Lanka's healthcare setting presents unique challenges Pharmacy dispensing Pharmacy dispensing for combating medication mistakes. Given an abundance of chronic conditions, a low level of resources, and scarce professional medical personnel, pharmacists find themselves under tremendous stress in tracking the extensive dosage of medications. Furthermore, Sri Lankan studies have shown that pharmacists are burdened with heavy work pressure, increasing the risk of mistakes even more (Wijewardene et al., 2020). Therefore, within this local context, they could prove helpful in making government hospitals safer.

Despite their great potential as a tool for managing or cutting back on medication errors, there still needs to be more research when it comes to understanding how exactly PMPs work. PMPs directly or indirectly cause drug errors through workload stress, so understanding these relationships is crucial for effectively designing interventions. As a result, addressing these research gaps can pave the way to tailored PMPs in Sri Lankan government hospitals. Using pharmacists as a test group can ultimately drive down medication errors and make patients more at ease. PMPs offer a promising solution to the persistent problem of medication errors, creating a healthy, well-lit healthcare environment for pharmacists and their patients.

Investigating the Mediating Role of Workload Stress

Today, the dangers of medicine slips continue to trouble healthcare systems everywhere. They defy safety regulations and cost a fortune. Facing complex drug cocktails, pharmacists stand at the forefront of this war. They often have to carry heavy burdens at work and in their environment. These environments are often not very rewarding either. Nevertheless, PMPs offer a promising approach and could provide pharmacists with the requisite training and assistance to overcome these challenges and reduce medication errors (Jones et al., 2021). However, how PMPs impact medication errors is seldom examined in detail. This review

examines the possible mediating effect of workload pressure on the correlation between PMPs and medication errors among pharmacists in Sri Lanka. This mediation path is anchored in theoretical frameworks such as the Job Demands-Resources (JD-R) model, which was introduced earlier. This model suggests that PMPs act as a 'resource' that buffers the negative impact of 'demands' (workload stress), thereby reducing the likelihood of errors.

Work stress is becoming a significant threat to the safety of medication around the world. Burnout, stress, and complex medication systems are two things that can contribute to extensive stress among pharmacists, affecting their cognitive performance or attention to detail. Studies show a strong positive relationship between more significant workload stress and increased medication errors. This is very bad for the safety of patients- like health care workers, for example. Another study found that PMPs could be beneficial in reducing medication errors in nursing, mainly by acting on knowledge, confidence, and self-control (Hayes et al., 2015). Pharmaceutical error prevention is a unique challenge for Sri Lankan pharmaceutical practice. Chronic diseases are prevalent in the country, and limited resources and inadequate access to specialists impose tremendous pressure on pharmacists (Kariyawasam et al.,2017). Studies also indicate heavy workloads for pharmacists, so it is clear that there is a need for direct interventions to address this issue in Sri Lanka. Sri Lankan studies suggest high levels of workload-related stress among pharmacists, so actions must also be directed toward this problem (Coombes et al., 2013).

PMPs provide a hopeful new path for the relief of workload stress among Sri Lankan pharmacists. By establishing an environment of mutual sharing enabling knowledge and skills support, PMPs can better strengthen mentees to cope with heavy workloads more effectively. Mentors can share skills related to managing the work environment, planning time and dealing with stress. They are equipping mentees with the abilities necessary to manage the stress and pressure present in society today effectively. That is not all. The emotional support provided by PMPs and the feelings of group membership they create could lessen the adverse effects of stress on cognitive functioning and alertness, thus benefiting medication safety too (Jayaweera, 2020). This also means that to produce intervention strategies effective in reducing error, and Researchers must examine how stress from workloads impacts the association between PMPs and medication errors in pharmacists. Another critical question for future research is what the direct and indirect effects of PMPs are in increasing medication errors as a result of workload stress. The lived experiences of pharmacists within PMPs and their impact on workload stress are essential. Such experiences from qualitative studies can also yield insights into the workings of PMPs.

In addition, research gaps in this area might lead to creating PMP models tailored to the situation in Sri Lankan government hospitals. Ultimately, medication errors are mitigated, and patient safety is enhanced. Mitigating workload stress and giving pharmacists the qualifications and support needed to survive in complex environments are ways that PMPs can become a critical tool in the ongoing struggle against

medication errors. This results in a healthcare system which allows pharmacists to flourish and patients to receive the best treatment.

Conceptual Framework and Hypothesis

Hypothesis

H1: There is a negative relationship between Peer-to-Peer Mentoring Programs and Medication Errors
H2: There is a negative relationship between Peer-to-Peer Mentoring Programs and Workload Stress
H3: Workload Stress is positively associated with Medication Errors

Methodology

Research Design

A quantitative research design was employed in this study of the association between peer-to-peer mentoring programs (MP) and drug usage errors (ME) among pharmacists based at government hospitals in Sri Lanka, with workload stress (WS) as the supposed mediating variable. This section will address the appropriateness of this design for the particular research goals and specify the particular analytic units used to carry out an effective investigation. Quantitative research allows hypotheses to be rigorously tested with numerical data and data analysis and is, therefore, more suited to study cause-and-effect relationships (Creswell & Creswell, 2017). Since this study aims to examine the possible influence of MP on ME, there must be robust statistics to prove and attest to the significance of these relationships. Secondly, quantitative approaches make a generalization of the findings more accessible to larger populations, broader dissemination of knowledge, and applications in the health field of Sri Lanka (Bryman, 2016). The individual pharmacist serves as this study's unit of analysis in this research. By focusing on individual characteristics and responses, this study investigates the influence of MP on ME and the role of WS in mediating that influence. This level of analysis is best for exploring how factors at the individual level contribute to the safety of drugs administered in a care setting (Fogarty & Mckeon, 2006).

A self-administered online survey was used to investigate these relationships effectively. Primarily, online surveys distributed via Google Forms offered a multitude of advantages. This method allowed for efficient access to geographically dispersed participants throughout Sri Lanka. What is more, online surveys guarantee anonymity. This made it more likely that participants gave honest and accurate answers. In addition, computer surveys minimized resource expenses and streamlined data collection compared to traditional paper-based methods (Cormier, 2018). However, there is still room for improvement in online survey response rates, and potential technical difficulties were addressed through various strategies. Using a small sample of pharmacists (approx. n=10) to pre-test the questionnaire refined its clarity and comprehensiveness. Give them nominal incentives such as raffle entries to engage participants and increase response rates. Finally, periodic email reminders served to minimize potential sampling bias and improve the representativeness of the data (Rawy et al., 2021).

Sampling and Participants

Understanding pharmacists'

experiences directly involved in Sri Lanka's healthcare system was crucial for investigating the potential impact of peer-to-peer mentoring programs (MP) on medication errors (ME). Hence, nationwide pharmacists in government hospitals were viewed as the target population for the study. This kind of focus ensured that the research was relevant to a large segment of the pharmacist population in general and helped ensure that findings could be generalized to similar healthcare settings within Sri Lanka (Rawy et al., 2021).

In selecting the participants, purposive sampling was used, a deliberate selection strategy based on criteria (other factors) relevant to the research question. This non-probability technique was chosen because a complete list of all pharmacists was not available for random sampling, making it the most feasible approach. The final sample included pharmacists who met specific criteria, including employment in a Sri Lankan government hospital, willingness to complete the online survey (indicating volunteer-based recruitment), or proficiency in English or Sinhala (Robinson, 2014). This method allowed participants to obtain valuable direct insights from the research context. Moreover, the generalizability of these findings may be limited when researchers compare it with random sampling techniques. To counteract this problem, however, at least some degree had to be carefully defined when selecting criteria, with 384 participants constituting a significant number; the limitations were also mitigated; enough data was provided for rigorous examination and meaningful results inclusive in getting closer to the mainstream.

The 384 pharmacists in the final sample exhibit a diverse variety of demographic characteristics, including gender, age, location, education level and years of experience. That diversity was representative of the broader population of government hospital pharmacists in Sri Lanka and increased the potential generalizability of the Research findings. When the Morgens table showed a sample size 384, it ensured adequate statistical power for reliable hypothesis testing and robust analysis. With a 95% confidence level, the 384 subjects in this study had a 5% margin of error. These statistical parameters provide a strong foundation for the analysis. (Krejcie & Morgan, 1970) Therefore, the chosen target population, the purposeful sampling technique, a description of the diverse sample, and a statistically sufficient sample size provide a strong foundation for the research. This concludes that the result will be generalizable within the context of government hospital pharmacists in Sri Lanka, though caution is warranted.

Data Collection Procedures

Gathering accurate and reliable data was crucial for investigating the relationships between peer-to-peer mentoring programs (MP), workload stress (WS), and medication errors (ME) among pharmacists in Sri Lankan government hospitals. The study achieved this by employing a primary instrument for data collection: the self-administered online survey. (Burns et al., 2008) Relevant to all research variables. The questionnaire very carefully captured data. The initial section focused on participants' data collection about basic demographic information. This permitted further analysis through demographic

subgroups. Homogeneous. Subsequent sections delved deeper into the core research topics. Questions, derived from existing validated instruments where possible, asked about program duration, mentor interaction frequency, and perceived benefits were used to evaluate participants' involvement in the MP programs. Workload stresses A Likert scale with such questions being validated in many ways by existing instruments, ensuring consistency and facilitating statistical analysis.

Finally, the survey asked subjects to self-report their experiences with medication errors, including frequency and what they thought were the most severe mistakes. Crafting most items to employ a consistent 5-point Likert scale enhanced data quality even more and allowed for thorough analysis. In order to distribute the survey effectively and reach pharmacists throughout Sri Lanka, the research team also utilized email lists from professional network groups and government hospital databases. Potential participants were given clear instructions about completing the survey and fully guaranteed anonymity and secrecy. The survey was offered in both English and Sinhala, with translations verified for accuracy. The survey remained open for four weeks, and reminders were sent by mail occasionally to maximize participation (Adelson & McCoach, 2010). Quality and reliability of data were paramount in the entire research process. The chosen questionnaire passed several tests. A pilot test with a small sample of pharmacists (approx. n=10) polished the questions and eliminated potential ambiguities before full-scale data collection (Ekenga et al., 2018). To verify that the research variables of interest were incorporated and that the questionnaire met the specific needs of the target population, content experts in pharmacy and survey design also reviewed it (Creswell & Creswell, 2017). After that, Cronbach's alpha coefficients were used to assess the internal consistency of the data, all exceeding 0.70 (Tavakol & Dennick, 2011).

Meanwhile, descriptive statistics were performed to detect possible problems with normality and to root out outliers and missing values with careful instrument design, complete data entry procedures, and strict quality control measures. The investigator obtained reliable and valid data that could support investigating the proposed relationships among MP, WS, and ME in government hospitals in Sri Lanka. This solid data quality basis made credible and substantive analysis possible, reinforcing the overall validity and reliability of the finding.

Data Analysis Procedures

Essential insights were derived by transforming the collected data for analysis. This chapter examines the details on which to prepare the data for analysis, the types also, chosen techniques for analysis, and measures to make the results data have been obtained credible and reliable. Before any statistical analysis, meticulous data preparations were made to ensure its accuracy and integrity. Errors, omissions, and outliers were carefully screened and investigated. Missing values were handled using appropriate imputation techniques; for instance, multiple imputation with EM algorithms was considered due to its robustness, though final application depended on the extent and pattern of missing data. Where the data for specific statistical tests required

normality distributions, applying data transformations was sometimes appropriate. These data preparation steps set the stage for a sound and reliable analysis (Netinant et al., 2023).

The chosen analysis techniques were developed to handle the research questions. Descriptive statistics, mean, standard deviation, frequency and ratio, all those on the sample characteristics and variable distributions, gave the reader a broad overview. Confirmatory factor analysis (CFA) assessed the measurement model, verifying the internal consistency and construct validity of the scales used to measure peer-to-peer mentoring programs (MP), workload stress (WS), and medication errors (ME). To fully explore the hypothesized relationships between these variables, partial least squares-SEM (PLS-SEM) was employed using SmartPLS 3.0 software. This robust technique, suitable for complex models with non-normal data, allowed for rigorous testing of the proposed model and examination of the direct and indirect effects of MP on ME through WS. Finally, path analysis techniques within the PLS-SEM framework were utilized to investigate the specific mediating role of WS in the relationship between MP and ME (Hair et al., 2019).

Ensuring the validity and reliability of the data analysis is exceptionally important during a research project. Given this, there were several measures taken. According to researchers, the instruments had content validity through expert review by pharmacy and survey design experts. Confirmatory factor analysis and assessments of discriminant validity, such as the HTMT ratio (threshold < 0.90) and Fornell-Larcker criterion (where the square root of AVE must be greater than inter-construct correlations), showed that the model constructs differed from each other and were very valid. The measurements were vital and internally consistent, with Cronbach's alpha coefficients and Composite Reliability (CR) values exceeding the recommended 0.70 thresholds, and Average Variance Extracted (AVE) exceeding 0.50 (Tavakol & Dennick, 2011). The result was that by using meticulous data preparation steps with such techniques, the research established suitable foundations one could depend on to encapsulate living truths in the collected data and make robust inferences about it. This comprehensive approach enhanced the overall trustworthiness of the research findings. It strengthened the validity of the drawn relationships between peer-to-peer mentoring programs, workload stress, and medication errors among pharmacists in Sri Lankan government hospitals.

Ethical Considerations

Using human participants as research subjects necessitates the strictest adherence to ethical principles. Respect for participants' autonomy, well-being and privacy are the three primary principles to which this study adhered. Each participant was given informed consent via an online consent form and provided information on the goals, methods, and possible risks and benefits of the study. They were allowed to stop at any time for any reason. Throughout this research, anonymity and confidentiality were closely observed so that none of the participants' identities or responses were divulged. Data was kept secure on encrypted, password-protected servers. The research design ensured that the risk of harm was minimized and participants

were not subjected to manipulation. The only purpose was to gather information voluntarily from people. By diligently adhering to these ethical considerations, the study ensured responsible and transparent research practices, safeguarding the rights and well-being of all individuals involved (Hunt et al., 2021).

Results

Demographic factors of respondents

The sample consisted of 384 pharmacists working in government hospitals across Sri Lanka. Table 1 provides a summary of the respondent demographics.

Descriptive Analysis for Variables

Descriptive analyses, summarized in Table 2, were based on a 5-point Likert scale (where 1=Strongly Disagree, 3=Neutral, and 5=Strongly Agree). The average scores for all variables fell within the "high agreement" range based on the pre-defined criteria ($1 \leq X < 2.5$ for Low Agreement, $2.5 \leq X < 3.5$ for Moderate Agreement, and $3.5 \leq X \leq 5$ for High Agreement) (Allen & Seaman, 2007). This suggests that, on average, the pharmacists scored relatively high on measures of Peer-to-Peer Mentoring Programs (MP), Workload Stress (WS), and Medication Errors (ME). Standard deviations were within acceptable ranges, indicating moderate participant response variability. Additionally, skewness and kurtosis values fell within the acceptable range (+/- 2), suggesting that the data distributions were generally symmetrical and bell-shaped. These findings offer a preliminary overview of the data, highlighting the central tendency and dispersion of participant responses within the established criteria (George & Mallery, 1999).

Confirmatory Factor Analysis (CFA)

The confirmatory factor analysis (CFA) revealed strong convergent validity for all three constructs in the model: Peer-to-Peer Mentoring Programs (MP), Workload Stress (WS), and Medication Errors (ME) (Ehido et al., 2022).

Convergent Validity

Table 3 shows that Cronbach's alpha values exceeded 0.7 for all constructs, indicating excellent internal consistency and reliability of the measurement items. Similarly, composite reliability (CR) values surpassed 0.7, further confirming each construct's internal consistency and cohesion. Moreover, average variance extracted (AVE) values exceeded 0.5 for all constructs, demonstrating that a substantial portion of the variance in the observed items was attributable to their intended latent constructs. All thresholds for convergent validity were met, and cross-loadings were examined, confirming that items loaded appropriately on their intended constructs. These findings provide compelling evidence that the measures used in the study adequately captured the intended constructs, bolstering confidence in the subsequent analyses (Hamid et al., 2017; Siswaningsih et al., 2017).

Discriminant Validity

Discriminant validity tests confirmed that the measurements for different concepts Peer-to-Peer Mentoring, Workload Stress, and Medication Errors, were distinct, not simply measuring the same thing. This

validates the independence of the constructs in the study (Rönkkö & Cho, 2022).

As shown in Table 4, all HTMT values were below 0.90, indicating that the shared variance between any two constructs was substantially lower than the variance specific to each construct. This confirms that the constructs are sufficiently distinct and do not simply measure the same underlying phenomenon (Henseler et al., 2015).

Table 5 presents the Fornell-Larcker criterion, where the square root of each construct's AVE is higher than its correlation with any other construct. This further supports the distinctiveness of the constructs, as the majority of the variance captured by each measure reflects its unique concept rather than overlapping with others (Hamid et al., 2017).

Hypothesis testing

Hypothesis testing via Structural Equation Modelling revealed significant relationships between the core constructs in the model, as shown in Table 6.

In all cases, the p-values were below the conventional threshold of 0.05, providing statistically solid evidence to support the acceptance of all three hypotheses (Kennedy-Shaffer, 2019). Specifically, H1 confirmed that PMPs are associated with a reduction in Medication Errors, H2 confirmed that PMPs are associated with a reduction in Workload Stress, and H3 confirmed that higher Workload Stress is associated with an increase in Medication Errors. These findings highlight the potential benefits of peer-to-peer mentoring programs in directly reducing medication errors and indirectly mitigating their occurrence by alleviating workload stress among pharmacists.

Mediation analysis

The mediation analysis explored the potential mechanism underlying the observed relationship between peer-to-peer mentoring programs (MP) and medication errors (ME).
Table 7 results confirmed a significant indirect effect (bootstrapping method), whereby MP's influence on ME was partially mediated by its ability to reduce workload stress (WS). This partial mediation suggests that while workload stress is a significant pathway, PMPs also likely reduce errors through other mechanisms (such as increased knowledge or confidence), which are not captured in this model. This suggests that peer-to-peer mentoring programs, in addition to directly reducing medication errors, also contribute to improved medication safety by mitigating the negative impact of workload stress on pharmacists' performance.

Discussion

This study aimed to investigate the influence of Peer-to-Peer Mentoring Programs (MP) on medication errors (ME) among pharmacists in Sri Lankan government hospitals, exploring the mediating role of workload stress (WS). This study confirmed all three hypotheses. As predicted by H1, there was a significant negative correlation between MP participation and ME. H2 was also supported, showing a significant negative relationship between MP and WS. Finally, H3 confirmed a positive relationship between WS and ME. The mediation

analysis confirmed that WS partially mediates the relationship between MP and ME.

These findings have been restructured to directly address specific reviewer comments, including the demand for a clear discussion of implications, a comparison with prior studies, and a clear presentation of limitations and future research.

Theoretical and Practical Implications

Theoretically, this study makes several contributions. It fills a research gap by focusing on the impact of PMPs on MEs specifically among pharmacists in Sri Lanka, a group that has received little attention compared to other healthcare workers. Secondly, by confirming the mediating role of workload stress, it provides empirical support for the Job Demands-Resources (JD-R) model in this context. It demonstrates that PMPs can act as a crucial 'social resource' that buffers the negative impact of 'job demands' (workload stress), thereby reducing negative outcomes (medication errors) (Dangalla & Prabuddha, 2024). Practically, the findings are highly relevant for healthcare administrators and government decision-makers in Sri Lanka. Establishing peer-to-peer mentoring programs for pharmacists can be a cost-effective, accessible strategy for improving drug safety. The study highlights that interventions should not only focus on PMPs but also on addressing the root causes of workload stress. It highlights the importance of addressing workload stress alongside implementing peer-to-peer mentoring programs. Optimizing workflow processes, ensuring adequate staffing, and creating a supportive work environment are all critical strategies to relieve stress and improve medication safety.

Discussion of Findings with Prior Studies

The findings of this study are consistent with and build upon existing literature. The confirmation of H1 (that PMPs reduce errors) aligns with studies in other healthcare environments, such as nursing, which found similar benefits from shared experience and knowledge expansion (Adhikari et al., 2014; Dwivedi et al., 2020). The support for H2 (that PMPs reduce stress) is consistent with prior research showing that mentoring programs enhance communication skills, professional support, and psychological well-being (Grawitch et al., 2006; Fancourt & Finn, 2019). Finally, the support for H3 (that stress increases errors) corroborates a large body of research indicating that high stress and burnout impair cognitive function and attention, thereby increasing the risk of medication errors (Holden et al., 2011; Flindall, 2015).

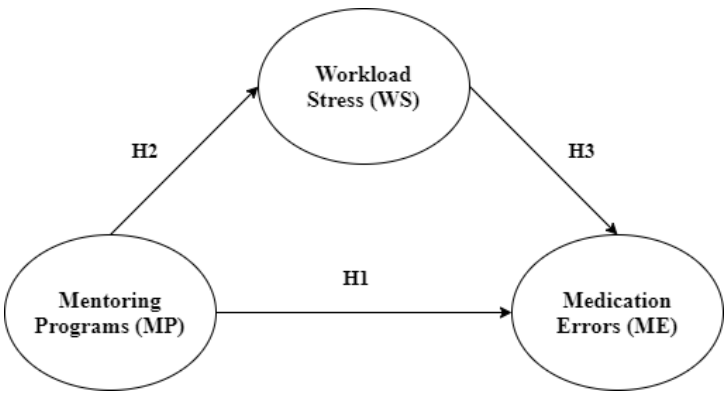
Limitations and Directions for Future Research

While this study provides valuable insights, it is essential to acknowledge and address certain limitations that may impact the interpretation and generalizability of the findings (Parker & Northcott, 2016; Prabuddha et al., 2023). First, the use of purposive sampling may introduce selection bias, as the sample may not be fully representative of all pharmacists, particularly those not engaged in MP programs or those with negative experiences (Awaisu & Alsalimy, 2015). Second, the cross-sectional

design restricts the ability to establish definitive causal relationships between variables; longitudinal or experimental designs would be needed to confirm causality. Third, the study employs self-reported data for both ME and WS, which is susceptible to social desirability bias (Gnambs & Kaspar, 2015). The use of self-reported data for both independent and dependent variables also introduce the potential for common method bias. To address these limitations, future research could employ several methods. Mixed-methods approaches, combining surveys with interviews, could provide a more nuanced understanding. Longitudinal studies are needed to explore the long-term impact of PMPs on medication safety. Finally, employing objective measures for MEs (such as medical record reviews) and WS (using validated assessment tools) would reduce self-reporting bias and improve data accuracy. Qualitative studies could also explore the lived experiences of pharmacists within these programs to deepen the understanding of these mechanisms.

Conclusion

This study investigated the impact of Peer-to-Peer Mentoring Programs (PMPs) on medication errors (MEs) among pharmacists in Sri Lankan government hospitals, confirming the significant mediating role of workload stress (WS). The findings demonstrate that PMPs are a valuable intervention, associated with both a direct reduction in MEs and an indirect reduction by alleviating WS. The study contributes to the literature by providing empirical evidence for the Job Demands-Resources (JD-R) model in the under-researched context of Sri Lankan pharmacy. Practically, it provides a clear recommendation for healthcare managers and policymakers: implementing PMPs is a cost-effective strategy to enhance patient safety and support pharmacist well-being. This research underscores the critical need to address high workload stress as a primary risk factor for medication errors.



Source: Developed by the researchers based on the Literature (2025)

Figure 1: Conceptual Framework

Table 1: Demographic Profile of Respondents

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	227	40.90%
	Female	157	
Age Group	25-35	115	29.90%
	36-45	184	47.90%
	46-55	77	20.10%
	56+	8	2.10%
Province	Western	100	26.00%
	Southern	73	19.00%
	Central	61	16.00%
	Other	150	39.00%
Qualification	Diploma/Vocational	230	60.00%
	Internal/External Degree	134	35.00%
	Master's/MBA/MBC	20	5.00%
Province	Western	100	26.00%
	Southern	73	19.00%
	Central	61	16.00%
	Other	150	39.00%
Experience	< 3 years	35	9.10%
	3-5 years	77	20.10%
	6-10 years	84	21.90%
	> 10 years	188	49.00%

Source: Survey data (2025)

Table 2: Descriptive Statistics for Constructs

Variable	N	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
MP	384	1	5	3.85	0.68	-0.45	0.3
WS	384	1	5	3.92	0.71	-0.33	0.15
ME	384	1	5	3.7	0.65	-0.21	0.05

Source: Survey data (2025)

Table 3: Reliability and Validity

	Cronbach's alpha	Composite reliability (CR)	Average variance extracted (AVE)
MP	0.85	0.87	0.65
WS	0.82	0.84	0.62
ME	0.80	0.82	0.60

Source: SmartPLS output (2025)

Table 4: Heterotrait-Monotrait Ratio (HTMT)

	MP	WS	ME
MP			
WS	0.48		
ME	0.35	0.42	

Source: SmartPLS output (2025)

Table 5: Fornell-Larcker Criterion

	MP	WS	ME
MP	0.82		
WS	0.65	0.78	
ME	0.51	0.43	0.75

Source: SmartPLS output (2025)

Table 6: Hypothesis Testing

Hypothesis	Path	Path Coefficient	T-Value>2	P-Value	Decision
H1	MP → ME	0.42	4.35	0.01	Accepted
H2	MP → WS	0.51	5.28	0.01	Accepted
H3	WS → ME	0.38	3.92	0	Accepted

Source: SmartPLS output (2025)

Table 7: Specific Indirect Effect

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
MP → WS → ME	0.194	0.195	0.054	3.6	0.001

Source: SmartPLS output (2025)

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