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RESEARCH ARTICLE

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Pharmacists' interventions on prescribing errors in Malaysia

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ABSTRACT

Background: Prescribing errors (PEs) cause significant avoidable harm globally. In Malaysia, despite the prevalence of PEs in government healthcare facilities, there is limited research on how pharmacist staffing levels influence intervention frequency and effectiveness. This study aims to address this gap by analysing intervention trends and assessing their association with staffing levels, highlighting the correlation between increased pharmacist presence and the frequency of interventions.

Methods: This retrospective cross-sectional study analysed data from the Ministry of Health's Pharmacy Management Form and the Pharmacy Board Registry from 2017 to 2019. Multivariate regression and two-way ANOVA assessed the association between the number of pharmacists, total prescriptions, and interventions on PEs in Health Clinic Outpatient Pharmacy, Hospital Outpatient Pharmacy, and Hospital Inpatient Pharmacy settings.

Results: Annually, pharmacists intervened in approximately 1.8% of total prescriptions, with the most common errors being wrong dose, wrong medication, and wrong dosing frequency. These interventions were consistent across all settings, highlighting the uniformity in pharmacists' approach to managing PEs. The regression analysis revealed a significant positive correlation between the number of pharmacists, total prescriptions, and interventions on PEs, with an adjusted R-squared value of 0.899. Both the number of pharmacists and total prescriptions received were positively significant ($p < 0.05$), indicating that increased pharmacist presence strongly correlates with intervention frequency. No statistically significant differences were observed in intervention rates across different settings and severity levels, suggesting that pharmacists consistently provide effective interventions irrespective of the clinical context.

Conclusion: In conclusion, this study confirms that increasing the number of pharmacists and total prescriptions received are critical predictors of interventions on PEs in Malaysia. It underscores the vital role of pharmacists in enhancing patient safety and healthcare quality, demonstrating their effectiveness in diverse settings and their adaptability to various patient needs and challenges.

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1. Introduction

Healthcare systems globally are facing unprecedented challenges due to an aging population and an increase in noncommunicable diseases, leading to a surge in medication use and, consequently, higher risks of medication errors (MEs) and adverse drug reactions (ADRs) (Alzahrani et al., 2021; Ministry of Health Malaysia, 2020; Watanabe, 2019). Recognising the critical need for enhanced patient safety, initiatives such as the WHO's Global Patient Safety Action Plan 2021–2030 and the resolution on global action on patient safety adopted at the seventy-second World Health Assembly in 2019 aim to mitigate the detrimental impacts of unsafe care practices, including the prevalence of medication errors (Jovanovic et al., 2020; Jovanovic et al., 2020; World Health Organization, 2021).

The incidence of medication errors is a worldwide concern. In the United States, for example, it's estimated that one medication error occurs per hospitalised patient per day, leading to significant morbidity and mortality (Michaels et al., 2010). Similarly, in Malaysia, the trend in reported medication errors is concerning, with specific studies indicating that these errors are not only prevalent but can lead to severe patient harm, including fatalities (Medical Development Division Ministry of Health Malaysia, 2020; Samsiah et al., 2016).

Among the various types of medication errors, prescribing errors (PEs) are particularly significant, constituting between 24 and 76% of all medication errors (Medical Development Division Ministry of Health Malaysia, 2020; Mulac et al., 2020; Samsiah et al., 2016). Pharmacists play a critical role in enhancing patient safety by screening and intervening in prescriptions before medications are dispensed. Recognising the complexities of medication management and the essential impact pharmacists have in the healthcare system, Malaysia has taken proactive steps to prioritise patient safety. In 2003, the country established the Patient Safety Council, reflecting a commitment to healthcare excellence. Following this, a 'Quick Guide in Preventing Prescription Error' was introduced, specifically designed to support pharmacists in reducing prescribing errors and enhancing patient outcomes. These initiatives demonstrate Malaysia's recognition of the vital role that pharmacists play in safeguarding public health (Medical Development Division Ministry of Health Malaysia, 2020; Patient Safety Council Malaysia, 2021). These initiatives reflect the country's commitment to reducing prescribing errors and enhancing patient outcomes. Moreover, the Ministry of Health Malaysia follows the World Health Organisation's recommendations for pharmacist

workforce density, which is a critical factor in error detection and intervention. This approach is echoed in other regions, such as Hokkaido, Japan, where future pharmacist supply is projected based on the number of prescriptions, underscoring the global recognition of pharmacists' pivotal role in healthcare (Morii et al., 2020; News Straits Time, 2017).

Despite the critical nature of their role, there is a notable gap in research focused on the impact of pharmacists in mitigating prescribing errors, especially within the Malaysian healthcare context. This study aims to bridge this gap by conducting a thorough investigation into the impact of pharmacists on prescribing errors across Malaysia's healthcare settings. The objectives of this study are to map the prevalence and patterns of prescribing errors, to investigate the types of prescribing errors that pharmacists intervene in, and to examine the distribution of pharmacists and their role in managing prescribing errors across different states. By delving into these aspects, the study aims to illuminate the crucial contributions of pharmacists in safeguarding patients against the risks of medication errors and in fostering a safer healthcare environment. Through a detailed exploration and insightful analysis, this research endeavours to highlight the indispensable role of pharmacists in not only addressing prescribing errors but also in advancing the broader goals of patient safety and quality care in healthcare systems globally.

2. Materials and methods

2.1. Study design & setting

This retrospective cross-sectional study was conducted from 2017 to 2019 across multiple centres in Malaysia, including 144 hospitals and 830 health clinics across the thirteen states and three Federal Territories. These numbers represent the total hospitals and clinics operating under the Ministry of Health Malaysia during the study period. It evaluated interventions by pharmacists on prescriptions in various settings such as health clinic outpatient pharmacies, hospital outpatient pharmacies, and hospital inpatient pharmacies. To ensure focused analysis, interventions specific to hospital settings, such as therapeutic drug monitoring and total parenteral nutrition, as well as recommendations unrelated to prescribing errors, such as suggestions for further monitoring of vital signs and laboratory investigations, were excluded. Confidentiality was maintained by withholding the names of pharmacists, prescribers as well as patients.

2.2. Data collection

Data were collected using structured data collection forms, PF forms 5.4 and 6.3(b), which are commonly utilised across all Ministry of Health (MOH)

Malaysia pharmacy facilities. Pharmacists recorded intervention details on these forms, which were then forwarded to the respective state health departments. These departments consolidated the records and sent them to the Pharmaceutical Services Program (PSP) for further aggregation. The data were subsequently entered into Microsoft Excel 365 and analysed using SPSS Version 25. The entry process was conducted by trained personnel, specifically pharmacists who are well-versed in data entry as it is part of their routine responsibilities. The double-entry verification method involved two levels of checks: first, the data entered by the pharmacists were verified by the person in charge (PIC) at each respective hospital or clinic, who oversees monthly data collection. The second round of verification was conducted at the state level when the datasets were submitted, enhancing data reliability. Descriptive statistical analysis reported the mean number of prescriptions received, interventions conducted on prescribing errors, types of prescribing errors, and the rate of interventions by pharmacists.

Additional demographic and workforce data concerning the number of registered pharmacists employed by the Ministry of Health Malaysia facilities in each state from 2017 to 2019 were extracted from the Pharmacy Board of Malaysia's annual registration list. Ratios of pharmacists to the population for each state were calculated using data from the Department of Statistics Malaysia, providing context to the registered pharmacists' workforce density and its potential impact on prescribing practices (Ministry of Health Malaysia, 2019; Ministry of Health Malaysia, 2020).

2.3. Classification of data

Prescribing errors were classified based on severity according to the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) (Shane & Palmer, 2011). Mild errors included deviations like prescriptions outside the approved formulary, illegible handwriting, and missing prescriber signatures. Moderate errors could potentially lead to patient discomfort or temporary clinical deterioration and included incomplete patient data, inaccuracies in medication name, dose, dosing frequency, and prescription duration. Severe errors, likely to result in significant patient harm, included wrong medication, incorrect dosages, wrong dosing frequencies or durations of treatment, and errors involving the wrong patient, among others.

2.4. Analysis of data

Multivariate linear regression analysis was employed to investigate the relationship between various predictor variables and the most frequently observed prescribing errors, focusing on the top three most prevalent error

types. The independent variables included the number of pharmacists, the total number of prescriptions, and the year. Regression coefficients were estimated using the ordinary least squares (OLS) method, with a *p*-value less than 0.05 indicating statistical significance. The goodness-of-fit for each regression model's explanatory power was assessed using R-squared and adjusted R-squared values to provide context on the proportion of variance explained by the predictors.

Additionally, a two-way ANOVA was performed to examine the impact of pharmacist interventions on prescribing errors across different healthcare settings, assuming normality and equal variances across groups, with a significance level set at $\alpha = 0.05$.

Study approval was secured from the National Medical Research Register (NMRR-19-4040-51772), and ethical approval was granted by the Medical Research and Ethics Committee (MREC) of the Ministry of Health Malaysia (MOH), ensuring that all research was conducted in compliance with national ethical standards.

3. Results

3.1. Pattern of reported prescribing error in public healthcare service across different regions and settings in Malaysia

From 2017 to 2019, an annual mean of approximately 75.5 million prescriptions was received across various healthcare settings (Table 1), with health clinic outpatient pharmacies receiving the highest number, significantly more than hospital inpatient and outpatient pharmacies (Figure 1). Of these, approximately 1.36 million prescriptions (1.8%) were identified with prescribing errors (PEs) and subsequently intervened by pharmacists (Table 1). Hospital inpatient pharmacies recorded the highest proportion of PEs, with about 677,205 cases (0.89%) despite receiving the fewest prescriptions (16.98 million), indicating a higher error rate compared to other settings.

Interventions on PEs were categorised by severity. Severe PEs constituted 63.4% ($n = 859{,}049$) of all PEs (Table 2), with the most common being wrong

Table 1. Mean of total prescription received (2017–2019) vs total interventions on prescribing error across different healthcare facilities.

	Total Prescription Received (Mean ± SD 2017-2019)			Total Interventions on Prescribing Error (Mean ± SD 2017-2019)		
	Health Clinic Outpatient Pharmacy	Hospital Outpatient Pharmacy	Hospital Inpatient Pharmacy	Health Clinic Outpatient Pharmacy	Hospital Outpatient Pharmacy	Hospital Inpatient Pharmacy
Total	37,938,000 ±1,468,920	20,558,220 ±638,812	16,978,401 ±1,221,828	336,190 ±33,324	341,886 ±20,434	677,205 ±19,758
%	50.3	27.2	22.5	24.8	25.2	50.0
Grand Total	75,474,621±255,194			1,355,281±23,997		

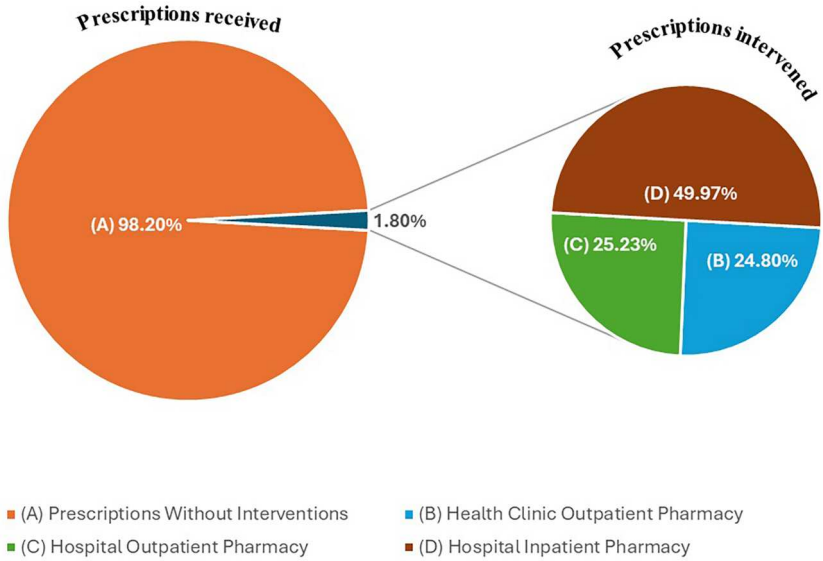

Figure 1. Illustration showing the breakdown percentage of prescriptions intervened from the total prescriptions received.

dose ($n = 308,549$; 22.8%), wrong medication ($n = 242,821$; 17.9%), and wrong dosing frequency ($n = 149,289$; 11.0%), consistently observed across all settings. Moderate PEs included issues like lack of authorisation from designated prescribers ($n = 158,999$; 11.8%), incomplete medication information ($n = 73,391$; 5.4%), and incomplete treatment duration ($n = 56,736$; 4.2%). The most frequent minor PE was illegible handwriting by the prescriber, noted in 34,002 cases (2.5%).

A breakdown of PEs by severity across different Malaysian states (Figure 2) showed that severe PEs were consistently the most common type throughout the three-year study period.

An analysis of the differences in pharmacist interventions on PEs, presented in Table 3, revealed no statistically significant differences in the number of interventions based on healthcare settings ($p = 0.09228$) or severity of errors ($p = 0.4151$). This suggests that pharmacist interventions were consistently applied across different settings and error severities, indicating a uniform approach to managing prescribing errors within the healthcare system.

3.2. Role of pharmacist in intervening the reported prescribing errors

Figure 3 offers an examination of the ratio of pharmacists to the population across various Malaysian states from 2017 to 2019. For example, in Perlis, the

Table 2. Mean summary of the type of prescribing errors and their severity across different healthcare facilities (2017–2019).

Severity of Prescription Error	Type of Prescription Error	Health Clinic Outpatient Pharmacy (Mean 2017–2019)	Hospital Outpatient Pharmacy (Mean 2017–2019)	Hospital Inpatient Pharmacy (Mean 2017–2019)	Total Mean Intervention (*n*)	Total
Mild	Illegible Handwriting by Prescriber	15,852 ± 1,951	9,300 ± 2,162	8,850± 439	34,002(2.5%)	64,176
	Prescribed medication not in Hospital/MOH Formulary	8,793 ± 602	10,154 ± 2,745	5,784 ± 590	24,731(1.8%)	(4.7%)
	Authenticity of Prescription	1,894 ± 698	1,214 ± 605	2,335 ± 1,037	5,443(0.4%)	
Moderate	No authorisation from designated prescriber	41,918 ± 3,509	52,116 ± 9,041	64,965 ± 735	158,999(11.7%)	432,057 (31.9%)
	Incomplete Medication Information	29,211 ± 5,994	18,729 ± 2,298	25,450 ± 1,989	73,390(5.4%)	
	Incomplete Treatment Duration	20,837 ± 1,665	18,079 ± 581	17,821 ± 1,649	56,737(4.2%)	
	Incomplete Patient Information	19,951 ± 2,013	8209 ± 2,399	23551 ± 2,897	51,711(3.8%)	
	Incomplete Dosing Information	21,014 ± 723	13,756 ± 289	13,053 ± 721	47,823(3.5%)	
	Incomplete Dosing Frequency	16,499 ± 854	14,158 ± 408	12,740 ± 1,030	43,397(3.2%)	
Severe	Wrong Dose	73,821 ± 19,309	84,287 ± 3,224	150,441 ± 3,656	308,549(22.8%)	859,048
	Wrong Medication	25,129 ± 4,532	30,825 ± 2,986	186,867 ± 20,807	242,821(17.9%)	(63.4%)
	Wrong Dosing Frequency	25,271 ± 4,130	37,517 ± 3,214	86,501 ± 3,902	149,289(11.0%)	
	Wrong Duration	18,082 ± 4,701	36,032 ± 8,714	48,009 ± 1,861	102,123(7.5%)	
	Polypharmacy	10,232 ± 944	4,344 ± 1,473	11,622 ± 5,730	26,198(1.9%)	
	Wrong Patient	3,938 ± 277	1,024 ± 120	10,760 ± 7,665	15,722(1.2%)	
	Contraindication	2,651 ± 342	1,235 ± 236	4,340 ± 749	8,226(0.6%)	
	Drug Interaction	760 ± 49	517 ± 74	2,325 ± 1,027	3,602(0.3%)	
	Patient Incompatibility	337 ± 54	390 ± 130	1,791 ± 70	2,518(0.2%)	
Total		**336,190**	**341,886**	**677,205**	**1,355,281**	100%

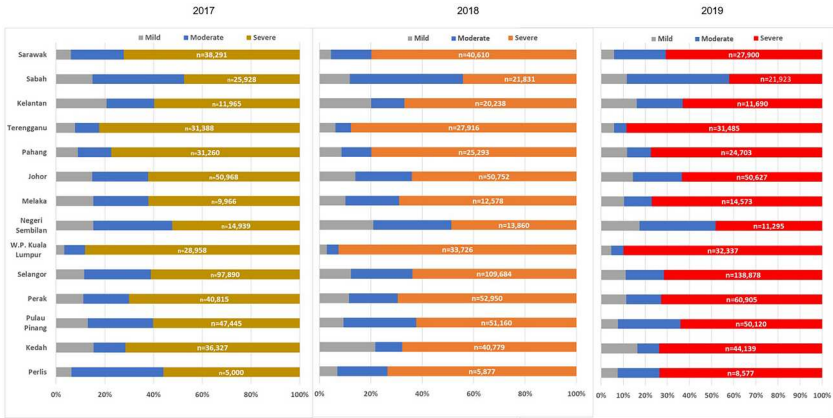

Figure 2. Breakdown of severity of prescribing errors by State (2017–2019).

Table 3. Two-way ANOVA analysis comparing differences in the number of interventions on prescribing errors conducted by pharmacists across various healthcare settings

Source	DF	Sum of Square (SS)	Mean Square (MS)	F Statistic (df1,df2)	*P*-value
Severity of Prescribing Errors	2	105,497,693,400	52,748,846,700	4.5838 (2,4)	0.09
Healthcare Setting	2	25,418,056,270	12,709,028,130	1.1044 (2,4)	0.4
Prescribing Errors	4	46,030,701,190	11,507,675,300		
Total	8	176,946,450,900	22,118,306,360		

highest ratio reported was one registered pharmacist per approximately 2,138 people in 2019 (reciprocal of 0.000467767). W.P. Kuala Lumpur and Pulau Pinang followed, with ratios of one pharmacist per approximately 2,495 and 2,611 people, respectively, in 2019.

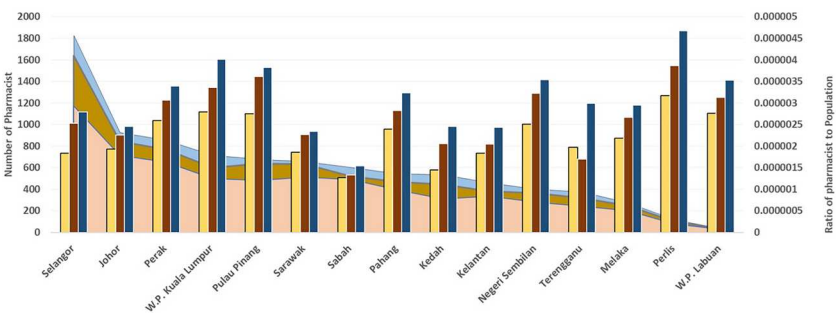

Figure 3. Total Number of Pharmacists from Year 2017–2019 in Ministry of Health Facilities by State vs Ratio Of Pharmacists To Population × 1000.

Over the study period, Selangor observed a notable increase in registered pharmacists under the Ministry of Health Malaysia, growing from 1,171 in 2017 to 1,824 in 2019. This increase corresponded with a decrease in the population per pharmacist, leading to a ratio of one pharmacist per approximately 3,584 people by 2019. Similarly, Johor saw an increase in registered pharmacists from 715 in 2017 to 926 by 2019, achieving a ratio of one pharmacist per approximately 4,065 people. Perak also showed positive growth, reaching a ratio of one registered pharmacist per approximately 2,941 people in 2019.

Other states, including Pulau Pinang, Sarawak, and Sabah, experienced positive trends in their ratios over these years. Although Perlis had a smaller total number of registered pharmacists, it displayed a high ratio, reaching one registered repharmacist per approximately 2,133 people by 2019. W.P. Labuan, with the fewest registered pharmacists, still showed consistent growth in its ratio, arriving at one registered pharmacist per approximately 2,841 people in 2019.

The general trend across most states indicates that interventions in hospital inpatient pharmacies were the highest (Figure 4). For instance, the average number of interventions in Johor's inpatient pharmacy was approximately 70,186, which was significantly higher than the 27,803 interventions reported on average at its health clinic outpatient pharmacies. However, this trend was not universal; in Labuan and Negeri Sembilan, the highest number of interventions occurred in health clinic outpatient pharmacies.

On average, a pharmacist at the Ministry of Health intervenes in 173 prescribing errors annually, with 63.5% ($n = 110$) of these errors being classified as severe.

Correlation analysis showed that the most strongly correlated errors with the number of pharmacists were wrong dose ($r = 0.94$), wrong medication ($r = 0.857$), and wrong dosing frequency ($r = 0.936$), all of which were statistically significant ($p < 0.01$) (Figure 5). These findings suggest that increases in pharmacist staffing are strongly associated with improvements in managing critical prescribing errors.

3.3. Association between pharmacist interventions on prescribing errors in Malaysia

The analysis presented in Table 4 revealed a significant positive association between the number of pharmacists and the interventions made on prescribing errors across Malaysia. Specifically, the regression coefficients indicate that for each additional pharmacist, there were 111.116 more total interventions made on prescribing errors, 20.587 more interventions on wrong drug regimens, 21.864 more interventions on wrong doses, and 11.876 more interventions on wrong dosing frequencies.

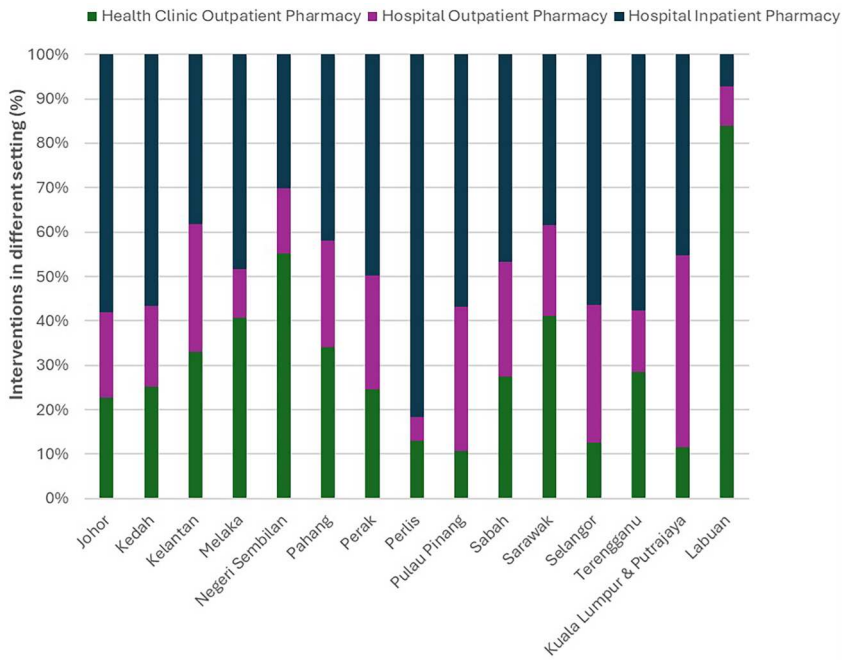

Figure 4. Percentage of interventions performed across different healthcare facilities and states.

4. Discussion

This comprehensive study, the first of its kind in Malaysia, evaluates the severity of prescribing errors and the crucial roles that pharmacists play in

Table 4. Multivariate linear regression analysis determining the association between the number of pharmacists, total prescriptions received, year and interventions of specific prescribing errors.

	Regression Coefficient			
	Total intervention B (Beta)	Interventions on Wrong Drug Regimen	Interventions on Wrong Dose	Intervention on Wrong Dosing Frequency
Number of pharmacists	111.116 *** (0.969)	20.587*** (0.712)	21.864*** (0.975)	11.876*** (0.964)
No. of Prescription	0.004	0.003 (0.045)	0.101	0.036
Year	−7395.933 *** (0.146)	−0.018	−1673.426*** (0.0169)	−775.486*** (−0.143)
R-squared	0.903	0.760	0.914	0.896
Adjusted R-squared	0.899	0.748	0.910	0.891

*Note: R-squared and adjusted R-squared values are provided to indicate the proportion of variance explained by the model. Statistical significance is indicated by ***, $p < 0.01$. The data is considered normal with skewness ranging between −2 to 2 and kurtosis ranging between −7 to 7 (Bryne 2010).

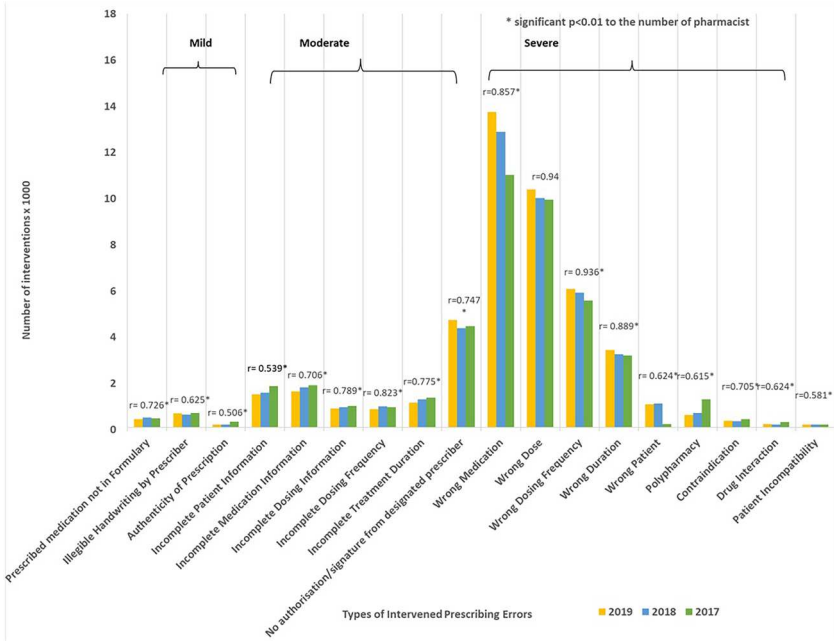

Figure 5. Correlation of the number of interventions on prescribing errors and their severity versus the number of pharmacists (2017–2019).

interventions across diverse public healthcare settings. Utilising a national database, this research provides a more generalised reflection of the population compared to most studies that focus on specific hospital wards (Alzahrani et al., 2021; Cabri et al., 2021; Waehner et al., 2020), or healthcare settings (Ooi et al., 2021; Yang et al., 2019).

Between 2017 and 2019, an annual average of 75.4 million prescriptions was processed in Malaysia, with 1.8% requiring pharmacist intervention to address potential clinical errors or to prevent adverse drug reactions (ADEs). This intervention rate compares variably with international figures, which range from as low as 0.35% in China to as high as 10.2% in Norway (Bao et al., 2018; Lustig, 2000; Vik et al., 2021). The variation in intervention rates globally may reflect differences in pharmacist screening practices and healthcare policies.

In line with prior research, dose discrepancies and incorrect medications were frequently reported as reasons for pharmacist intervention (Ashcroft et al., 2015; Lustig, 2000; Mulac et al., 2020; Shah & Manzi, 2018; Siang et al., 2003; Warholak & Rupp, 2009). Notably, this study found a much higher rate of harmful errors (63.4%) which may lead to severe harm or even death (Ashcroft et al., 2015; Avery et al., 2013). Such a high incidence of harmful errors could indicate reporting biases or highlight the actual severity of detected errors.

This research, being retrospective, reflects typical documentation practices by pharmacists in real settings, contrasting with many studies that rely on prospective data collection, which may enhance sensitivity to detect clinically significant prescribing errors. However, the retrospective nature might have led to an underestimation of interventions, particularly if busy pharmacists failed to document each intervention (Franklin et al., 2009). The elevated occurrence of harmful errors observed might therefore reflect a tendency to report more severe cases, potentially skewing the representation towards more critical incidents.

Moreover, interventions were notably higher in hospital inpatient pharmacies, a discrepancy likely due to the complex and acute nature of cases managed in these settings. Such environments may predispose to higher error rates due to factors such as prescriber fatigue and communication failures among healthcare staff (Alanazi et al., 2016). This finding underscores the importance of considering setting-specific strategies for error reduction, aligning with Reason's 'Swiss cheese' model of accident causation (Velo & Minuz, 2009).

The findings also indicated a robust uniformity in the pattern of pharmacists' interventions, suggesting that regardless of workplace setting, pharmacists adhere to stringent standards for managing prescribing errors. This consistency is crucial for ensuring patient safety across healthcare settings. However, deviations observed in Labuan and Negeri Sembilan, where interventions were more frequent in health clinics, suggest potential regional variations in prescribing practices or in the enforcement of error documentation policies.

Furthermore, the study highlights the need for a more equitable distribution of pharmacists relative to the population size. For example, although Selangor is the largest state in Malaysia and has the highest number of pharmacists, this does not translate to a high pharmacist-to-population ratio. This indicates that despite the absolute number of pharmacists, the ratio remains low due to the large population size in Selangor, highlighting the need for a more equitable distribution of pharmacists relative to the population size. These findings challenge the notion of an ideal pharmacist-to-population ratio by demonstrating the significant impact pharmacists have in intervening in prescribing errors, reducing potential harm to patients, and avoiding unnecessary hospitalisations. This underscores the need for policy adjustments to increase pharmacist staffing in both public and private healthcare sectors, ensuring that deployment strategies consider both the absolute number of pharmacists and the population size they serve to achieve optimal healthcare outcomes (Bates et al., 2016; Morii et al., 2020; Obamiro et al., 2022).

Additionally, the regression analysis highlights the critical impact of increasing pharmacist staffing on reducing prescribing errors, advocating

for policy adjustments to optimise pharmacist workforce levels to improve patient safety outcomes (Bates et al., 2016; Obamiro et al., 2022; Suzuki et al., 2022). Recognising the vital role of pharmacists and expanding their responsibilities can lead to the creation of more positions, thereby increasing the uptake of Provisionally Registered Pharmacist (PRP). This expansion can reduce the waiting time for fresh graduates to secure positions, ensuring a smoother transition into the workforce. Additionally, it can encourage more students to pursue pharmacy as a career, knowing that there are ample opportunities and a clear career path.

4.1. Limitations

While this study provides significant insights into the role of pharmacists in managing prescribing errors, there are inherent challenges in capturing every potential error. The study may not have captured all errors, particularly those not detected by pharmacists or errors inadvertently introduced during the intervention process. However, these instances are likely to represent a small proportion of the overall data and do not significantly detract from the findings presented. Moreover, although the data collection was based on voluntary reporting, which might lead to some degree of underreporting, the large sample size and comprehensive nature of the data collection across multiple settings help mitigate this limitation and ensure a robust analysis.

The study also did not measure the economic impact of pharmacist interventions. Future research should explore these economic aspects, which could provide compelling evidence for policy changes that highlight the financial as well as clinical benefits of effective pharmacist interventions. Studies like those conducted in France have shown significant cost savings from pharmacist interventions (Jourdan et al., 2018), indicating a potential for similar cost-effectiveness in Malaysia.

Finally, extending this research to include private sector healthcare settings could offer a more comprehensive overview of prescribing practices across the country, potentially leading to a more nuanced understanding and targeted policy interventions. The study suggests that pharmacists can contribute far beyond merely intervening in prescribing errors. Policymakers should consider expanding the roles of pharmacists to include more responsibilities in patient care, especially in the private primary care sector, which is currently more doctor-centric in Malaysia.(Ong et al., 2022)

4.2. Future directions and technological improvements

Implementing electronic prescribing in all Malaysian healthcare facilities is likely the solution to administrative causes of prescribing errors. Several

studies have shown that computer-aided prescribing based on electronic patient records reduces the error rate of prescriptions, especially those caused by illegible handwriting and prescribing outside of the formulary. These systems generate electronic prescriptions, which can significantly reduce errors on both the prescriber and dispenser sides. The software can pre-screen and pre-empt potential errors, enhancing overall medication safety (Bizovi et al., 2002; Buurma et al., 2001). The ongoing rollout of a full-based which includes full e-prescribing from the prescribers side utilising the Pharmacy Information System (PhIS) should be accelerated to maximise these benefits across all healthcare settings (Iyzati et al., n.d.; Program Perkhidmatan Farmasi, 2020).

Conclusion

This study underscores the critical role pharmacists played in intervening in prescriptions and highlights how increasing the number of pharmacists leads to better and safer patient health outcomes. By analysing data from pharmacies in Malaysian public health sector, it was found that pharmacists intervened in approximately 1.8% of total prescriptions. The extensive dataset used enhances the generalisability of the findings to the broader population.

Hospital inpatient pharmacies, despite receiving fewer prescriptions, accounted for nearly 50% ($n = 677{,}205$) of all interventions. This higher rate of interventions is likely due to the complexity of medication regimens typically found in hospital settings. Frequent reasons for interventions include incorrect medications and incorrect dosing, aligning with findings from similar studies globally. The implementation of e-prescribing in Malaysia is proposed as a potential solution to reduce these errors, supported by successful outcomes in other countries.

Currently, no state in Malaysia has reached the recommended pharmacist-to-patient ratio of one pharmacist per 1,600 persons, suggesting a need for increased staffing to meet basic healthcare requirements. Although this study offers comprehensive insights into prescribing practices and errors within Malaysia's public healthcare system, it relies primarily on secondary data from the Ministry of Health. This data source, while extensive, may not capture the detailed nuances of individual incidents. Moreover, the reliance on voluntarily reported data by pharmacists could introduce bias, particularly during busy periods, potentially restricting the depth of understanding regarding the causes of errors and the overall effect of interventions.

Future research should focus on addressing these limitations and exploring strategies to optimise pharmacist deployment and improve prescribing safety across Malaysia's healthcare landscape.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

Data can be obtained from the author on request.

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