Malaysian Journal of Social Sciences and Humanities (MJSSH) (e-ISSN : 2504-8562)
2025, Volume 10, Issue 10, e003617
DOI: https://doi.org/10.47405/mjssh.v10i10.3617

RESEARCH ARTICLE

Analysis of Determinants and Prevalence of Polypharmacy in Malacca

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KEYWORDS:
Polypharmacy
Malacca
Chronic-illness

CITATION:
Mohd Ikhmal Hanif, A. K., Nurfatin Najwa, R., Muhammadinil, F., Mohamad Hafiz, A. S., & Muhammad Iqbal, S.. (2025). Analysis of Determinants and Prevalence of Polypharmacy in Malacca. *Malaysian Journal of Social Sciences and Humanities (MJSSH), 10*(10), e003617. https://doi.org/10.47405/mjssh.v10i10.3617

ABSTRACT

Polypharmacy is referring to use of multiple medications. Over time, the definition of polypharmacy has evolved to encompass actions such as taking unnecessary or using multiple drugs from the same therapeutic category to treat a single disease or health problem. Generally, the concurrent use of five or more medications is widely accepted as a threshold for classifying polypharmacy. This condition is associated with an increased risk of negative health outcomes, as the potential adverse effects may outweigh the therapeutic benefits. A cross-sectional study was conducted to investigate the prevalence and factors associated with polypharmacy. A total of 400 participants, aged 20 to 78 years, were recruited for a questionnaire-based survey. Data analysis was performed using IBM SPSS version 22. The primary factors contributing to polypharmacy were identified using binary logistic regression. A p-value of < 0.05 was considered statistically significant. Of the 400 participants, 166 individuals (41.5%) reported taking more than five medications simultaneously, indicating a high prevalence of polypharmacy in Malacca. Binary logistic regression analysis revealed that the presence of multiple comorbidities was the most significant factor associated with polypharmacy in this population. The prevalence of polypharmacy in Malacca was high, with 41.5% of participants affected. The study identified the presence of

multiple chronic illnesses as the primary contributor to this trend. These findings are crucial for informing future research and interventions, and may serve as a reference for developing guidelines to manage and reduce polypharmacy in similar populations.

Contribution/Originality: This study advances polypharmacy literature for Malaysia overall and for Melaka specifically. It is the first study examining polypharmacy among Melaka residents in a nonclinical, general setting to our knowledge. The data provide unique, locally relevant insights, enhancing understanding of polypharmacy patterns and determinants among Melaka participants.

1. Introduction

Polypharmacy, commonly defined as the concurrent use of multiple medications, is a pervasive and growing phenomenon in modern healthcare. While definitions vary, a widely used operational threshold is the use of five or more medications. This operationalization aligns with clinical concerns about the cumulative risk of adverse drug events (ADEs), drug–drug interactions, medication non-adherence, and increased healthcare utilization. As populations age and multimorbidity becomes more prevalent, the scope of polypharmacy expands beyond elderly cohorts to include younger adults with complex clinical conditions and those with disabilities (Hosseini et al., 2018; Tian et al., 2023).

The drivers of polypharmacy are multifactorial. Demographic shifts toward older age groups intersect with the rising prevalence of chronic diseases such as cardiovascular disease, diabetes, cancer, and neurodegenerative disorders, all of which drive the need for multiple medications (Almodóvar & Nahata, 2019). Advances in pharmacotherapy, guideline-driven disease management, and access to prescription medications further contribute to higher medication counts. However, the benefits of pharmacological interventions must be weighed against potential harm; polypharmacy is consistently associated with increased risks of ADEs, hospitalizations, functional decline, cognitive impairment, falls, and mortality, particularly among older adults (Davies et al., 2020).

The global burden of polypharmacy is unevenly distributed. High-income countries often report higher prevalence due to longer life expectancy and more robust prescribing practices, yet low- and middle-income countries face unique challenges, including limited pharmacovigilance, fragmented care, and scarce resources for medication reconciliation and deprescribing initiatives. Moreover, disparities in health literacy, access to primary care, and social determinants of health contribute to variations in polypharmacy risk and outcomes across populations (Khezrian et al., 2020).

Polypharmacy bears direct implications for patient safety and health system performance. ADEs linked to inappropriate polypharmacy contribute substantially to emergency department visits and hospitalizations, particularly among older adults with frailty or functional impairment (Gutiérrez-Valencia et al., 2018). Medication-related problems undermine adherence and treatment effectiveness, complicate chronic disease management, and increase caregiver burden. From a health systems perspective, polypharmacy intensifies the need for comprehensive medication management (CMM), robust medication reconciliation at every care transition, and integrated clinical decision

support (CDS) tools that can help clinicians assess cumulative anticholinergic burden, drug–drug interaction risks, and duplications (Al-Maqbali & Al-Zakwani, 2024).

Despite substantial regional and global literature, knowledge gaps remain in understanding polypharmacy within Malaysia's health system. Malaysia faces a mix of public and private providers, with diverse electronic health record (EHR) adoption levels and fragmented care pathways across primary, secondary, and tertiary care settings. While national health databases offer valuable macro-level indicators, granular, patient-level data on polypharmacy prevalence, patterns of prescribing across specialties, and outcomes by demographic subgroups are less consistently captured. In addition, sociocultural factors—caregiver expectations, health literacy, and traditional medicine use—may influence medication regimens and adherence in Malaysia, warranting localized inquiry (Lim et al., 2017). The rapid digitization of health information systems and the expansion of e-prescribing and CDS present both opportunities and threats for safe polypharmacy management in Malaysia, including data privacy concerns, interoperability challenges, and the need for context-specific deprescribing guidelines.

A rigorous understanding of polypharmacy's root causes and consequences has immediate policy relevance. Health systems benefit from standardized definitions and surveillance frameworks to monitor prevalence and outcomes, coupled with targeted interventions such as comprehensive medication reviews, explicit deprescribing protocols, and multidisciplinary care teams. The integration of health information technology—interoperable EHRs, CDS that flag high-risk polypharmacy scenarios, and secure data-sharing mechanisms—can support safer prescribing and continuity of care. However, IT-enabled solutions must be designed with patient privacy, clinician workflow, and local clinical contexts in mind to avoid alert fatigue and workflow disruption

2. Literature Review

Polypharmacy, a term in use for over 150 years, refers to the simultaneous administration of multiple medications, particularly when some are unnecessary or when several drugs from the same category are used to treat a single health condition. Polypharmacy is commonly defined as the concurrent use of five or more medications. This threshold has gained prominence due to the array of negative health outcomes observed, especially among older adults**.** Malaysia, like many countries undergoing demographic transition, faces an increasing prevalence of non-communicable diseases (NCDs) such as diabetes mellitus, hypertension, and cardiovascular diseases. These trends have contributed to a rise in polypharmacy cases nationwide. Primary care clinics report high rates of polypharmacy among patients with multiple comorbidities (Rieckert et al., 2018), reflecting the complexity of managing chronic illnesses that often require multidrug regimens to achieve optimal therapeutic outcomes.

Polypharmacy is associated with several adverse consequences that threaten patient safety and strain healthcare resources. These include an elevated risk of adverse drug reactions (ADRs), drug-drug interactions, medication non-adherence, and potential misuse of medications (Masnoon et al., 2017). Such outcomes can lead to hospital re-admissions, increased morbidity, and unnecessary healthcare expenditures. These negative impacts underscore the need to address polypharmacy as a critical public health and clinical issue, especially given the increasing demands on Malaysia's healthcare system (Lim et al., 2017). Therefore, the effective management of polypharmacy—through strategies such as medication optimization, patient education, and the adoption

of healthcare technologies—is essential to improving therapeutic outcomes and ensuring patient safety. Enhancing existing policies, raising public awareness, and strengthening enforcement among healthcare practitioners are vital steps to managing the complexities of polypharmacy in Malaysia.

Despite its significant implications, the prevalence and determinants of polypharmacy in the Malaysian population remain inadequately documented, largely due to the limited number of nationwide studies. Additionally, inadequate healthcare data and inconsistent definitions further complicate the accurate assessment of polypharmacy. Most existing studies are localized or hospital-based, limiting their generalizability to the broader population. Consequently, the issue of polypharmacy has not been fully explored or addressed at the population level, even as rates of chronic disease and the aging population continue to rise (Lim et al., 2017). This gap restricts healthcare providers and policymakers from developing effective interventions to promote safe prescribing practices and optimize medication regimens. Without robust data on prevalence and determinants, identifying high-risk groups and aligning healthcare policies with population needs is challenging. This, in turn, limits progress towards improving medication safety and patient outcomes within Malaysia's healthcare system.

This study aims to analyse the prevalence of polypharmacy among various demographic groups in Malacca and to identify the key determinants contributing to its occurrence. Specifically, the study examines differences based on gender, ethnicity, employment status and educational level. In addition to documenting prevalence, the research seeks to elucidate the most significant demographic factors associated with polypharmacy in this population.

3. Research Methods

3.1. Study Design

This is a quantitative study where participants need to answer all online questions in the survey. The research was carried out by means of a cross-sectional online survey that was administered for residents in Malacca. Participants who answer all questions and submitted the questionnaire will be regarded as their consent to participate in this study. Inclusion criteria: age 18 years old and above; live and work in Malacca; understand *Bahasa Melayu* or English; Malaysia residents and answering all the question in the survey. Exclusion criteria: Ege less than 17 years old; live or work outside of Malacca; non-Malaysia resident and do not answer all the questions in the survey. The data was collected through self-administered online surveys. The study focused on Malacca as Malacca is among top 6 high density population in Malaysia. The state itself is unique as it has small land mass yet well developed with total of 6.3% of ageing population (Abdullah et al., 2024). The small land size of Melaka, with relatively limited urban–rural disparities, may contribute to distinctive socioeconomic diversity that influences polypharmacy patterns

3.2. Sample and data collection

For sample size a total of 377 participants were projected on online sample population calculator Raosoft tool calculator. The population calculator was set up to 5% margin of error, 95% confidence interval with 50% rate of response distribution. The questionnaires in the survey were prepared in Google form. Convenience sampling was

used to recruit participants using social media such as WhatsApp application and Facebook simply providing the survey google form. Facebook page with many members was selected and posted the survey. Such pages were as Melaka Daily and Jawatan Kerja Kosong di Melaka with 266K and 116.6K page members respectively. Data collected in google form was extracted in excel format for data trimming based on inclusion and exclusion criteria.

In this survey, a short and simple explanation on polypharmacy was included to assist participant to understand the questions. The survey comprises three components which is the first section includes demographic enquiries such as gender, age, ethnicity, employment status, education level and area of residence. The second component of this study includes questions regarding the prevalence of polypharmacy in Malacca while the third section addresses factors that may contribute to polypharmacy. Administration of survey. The research involved distributing the online survey link via WhatsApp, Facebook, Instagram, and Twitter. The rationale for selecting this method is just because it is efficient way in collecting information from respondents.

3.3. Data analysis

Statistical analysis. IBM SPSS statistic version 22 was employed to ascertain the compilation of this data. Data collected was trimmed based on inclusion, exclusion criteria and missing data was removed. Descriptive analysis was performed by identifying each item's frequency and percentage. Data distribution analysis was conducted using normality test of Kolmogrove-Smirnov; Shapiro-Wilk test. To identify determining factor of polypharmacy, Regression binary logistic was used to analyse ExpB, 95% confidence interval (CI) and p-value of major factors contributing to the rise in polypharmacy. The potential predictor factors included gender, ethnicity, employment status, area of residence, non-prescribed medication intake, concurrent use of multiple medications for the same health condition, multiple comorbidities, seeking medical advice before purchasing non prescribed medications and education level.

4. Results

A total of 400 people participated in this study. There were 216 (54%) female respondents, 184 (46%) male respondents. The respondents' age was between 20 to 78 years old. According to ethnicity, Malay (68.3%), Chinese (17.5%), Indian (14%) and (0.2%) Iban. In addition, (64%) of rural areas and (36%) from urban areas. Based on education, the majority have a diploma (28.5%) followed by a bachelor's degree (24.3%), secondary high school (17.3%) and no formal education (11.6%), master holder (7%) and the least philosophical doctorate holder (6.8%). Based on Table 1, 41.5% (n=166) were polypharmacy.

Table 1: Prevalence of polypharmacy

Polypharmacy	Frequency (n)	Percentage (%)
No	234	58.5
Yes	166	41.%

Based on Table 2, regression binary logistic analysis was employed to identify the independent factors contributing to polypharmacy. We found that the factors of gender (ExpB 1.805; 95% CI 1.08-3.03, p = 0.025), ethnicity (ExpB 1.735; 95% CI 1.03-2.93, p =

0.039), employment status (ExpB 0.435; 95% CI 0.26-0.73, p = 0.02), the presence of multiple illnesses (ExpB 5.485; 95% CI 2.97-10.12, p = 0.000) and education level (ExpB 0.562 ; 95% CI 0.33-0.97, p = 0.039) all exhibit $p< 0.05$. This indicates a significant association with polypharmacy.

Meanwhile other factors that not associated with polypharmacy were area of residence (ExpB 1.391 ; 95% CI 0.84-2.31, p = 0.203), use of non-prescribed medications (over the counter) (ExpB 1.017 ; 95% CI 0.57-1.81, p = 0.954), concurrent use of multiple medications for the same health condition (ExpB 1.662 ; 95% CI 0.84-3.30, p = 0.146) and seeking medical advice from doctor prior to purchasing non prescribed medications (ExpB 1.146 ; 95% CI 0.68-1.93, p = 0.607).

Table 2: Regression binary logic

Factor	Sig.	Exp(B)/OR	95% C.I
Gender (Male)	.025	1.805	1.075 to 3.028
Ethnicity (Malay)	.039	1.735	1.027 to 2.929
Employment status (Unemployed)	.002	.435	.258 to .735
Area of residence (Rural)	.203	1.391	.837 to 2.312
Taking non prescribed medication (Yes)	.954	1.017	.573 to 1.806
Taking medication more than 1 to treat same health condition (Yes)	.146	1.662	.838 to 3.296
Have more than 1 illness (Yes)	.000	5.485	2.972 to 10.121
Get advice doctor before purchase non prescribed medication (Yes)	.607	1.146	.681 to 1.928
Education level (High education)	.039	.562	.325 to .971

Note: C.I = Confidence Interval

5. Discussion

This study's findings indicate the prevalence and determinants contributing to polypharmacy in Malacca. This research identified the prevalence of polypharmacy (41.5%) in Malacca. It is lower than those reported in including other nations in the Asia Pacific region where the rates above 80% (Kim et al., 2014). Nevertheless, Switzerland reported a prevalence of polypharmacy that was 11.8%, which is lower than the findings of Khezrian et al. (2020). This difference is due to different research settings, the size of the older population in specific areas, the availability of healthcare facilities particularly in rural regions and the role of internet access in medication exposure through social media. As Switzerland is a developed nation, even their rural areas have better access to healthcare facilities and health promotion which reduce polypharmacy in their country compared to Malaysia. Additionally, demographic differences, awareness of medication side effects, lifestyle variations, socioeconomic factors such as income, educational disparities and cultural preferences regarding medication intake contribute to these discrepancies. In Southeast Asia, Singapore has reported polypharmacy prevalence rates of 48–55% among older adults (Ho et al., 2023), which is comparable to this study's findings. In contrast, Thailand's rates have reached 70% (Wongpakaran et al., 2018).

The regression binary logistic analysis revealed that the presence of multiple illnesses is strongly associated with polypharmacy (ExpB 5.485; 95% CI 2.97-10.12, p = 0.000). Even though the number of 95% CI was wide range but still it shows a strong association with polypharmacy. This explains that when ExpB = 5.49, it indicates that individuals in the

sample with more than one illness were 5.49 times more likely to experience polypharmacy and strongly associated compared to other factors. Logically speaking, when an individual has multiple comorbidities, it leads to increased frequency of purchasing non prescribed drugs rather than utilizing those provided by healthcare institutions. Therefore, it is possible to conclude that the more comorbidities are present, the more medication intake increases (Lim et al., 2017; Sinha et al., 2021) and it is possible to infer that this variable was the most significant and prevalent factor contributing to polypharmacy in Malacca.

Table 2 shows that the (ExpB 0.562) level of education was lower than the multiple illness. It can be highlighted that education level was not the main factor that influenced the increases in polypharmacy. Individuals that have higher education tend to experience polypharmacy than lower education level. The reason for that could be that individuals with higher education levels become more aware of their health condition, so it is possible they take a lot of supplements or medications because of their awareness. However, this result has been contradicted with Pereira et al. (2017) since it demonstrated that polypharmacy tends to decrease among those with higher educational levels. But a recent study by Majewski et al. (2024) revealed that in certain countries with lower education such as Jordan, there was still a significant incidence of polypharmacy, and it also showed that the relationship between educational level and polypharmacy was depends in certain countries. This is because there are currently limited findings regarding the relationship between polypharmacy and education level, even though education level is an essential element in polypharmacy (Majewski et al., 2024). So, we can assume that polypharmacy was not the main key of polypharmacy because the findings about this relationship are still unclear.

Gender showed (ExpB 1.805; 95% CI 1.08-3.03, p = 0.025), which indicate that 1.8 times of gender contribute to increases of polypharmacy. In this study, males (43.5%) have a higher number of polypharmacy than females. This result was consistent with studies Lu et al. (2015) and Kim et al. (2014) that revealed males have a higher number of medications and are more likely to be polypharmacy than females. It is possible that this issue is caused by male and female patients are treated differently by medical professionals on prescriptions (Kim et al., 2014). Whereas the findings of Al-Dahshan et al. (2020) shown that the probability of polypharmacy among females was 1.18 times more than males. Similarly, with Midão et al. (2018) prove that the predominant group of gender experience polypharmacy was female likely due to their increased health consciousness, resulting in more frequent and earlier contacts with health care providers compared to males. However, in this study gender was not the main predictor that contributed to polypharmacy. Nonetheless, no substantial disparities were seen between male and female participants regarding the likelihood of polypharmacy. Ethnicity (ExpB 1.735; 95% CI 1.03-2.93, p = 0.039) was the variable that does not contribute to polypharmacy since it only 1.7 times of ethnicity factor influence the number or polypharmacy. The data indicates that the Malays ethnicity was higher than the other ethnicities. This may be due to differences in cultural beliefs or perceptions regarding the consumption of multiple medications or it may be indicative that ethnicity was not a major influence in the rise of polypharmacy. In Assari and Bazargan (2019) research it was shown that polypharmacy had no relationship with race or ethnicity. But Lim et al., (2017) found that Malay and Chinese ethnic groups were less prone to experience polypharmacy compared to Indians, however the reasons for this disparity remained unclear. The variable of seeking medical advice before purchasing non-prescription medications was not significant with polypharmacy since (ExpB 1.146; 95% CI 0.68-1.93,

p = 0.607). Table 3 showed that individuals that get advice with doctors before purchasing non-prescription medications lead to polypharmacy, reason of that was because individuals that frequently consult with physicians have possibility to consult with more than one medical professional. Instead of that, even though they get the advice, some of them still purchase medications from outside and practice self-medication. This statement aligns with Sinha et al. (2021) it mentioned that one of the factors of polypharmacy was patients that used over-the-counter drugs for self-medication.

The factor of use non-prescribed medications (over the counter) (ExpB 1.017; 95% CI 0.57-1.81, p = 0.954) was usually expected contribute to polypharmacy, but in this study, it was not significant. This statement was aligned with Chang et al. (2021) that revealed polypharmacy and non-prescription medication use did not have a significant association. It is possible because they were not using an over-the-counter drug along with their prescription drug.

Concurrent use of multiple medications for the same health condition was not significant with polypharmacy as (ExpB 1.662; 95% CI 0.84-3.30, p = 0.146). Even though one of the studies from Christopher et al. (2023) mentioned that people who had been treated for high blood pressure for 5 years or more were twice as likely to be taking more than one drug at the same time. It is clearly shown that individuals that use multiple medication for their same health condition are most likely to experience polypharmacy but, in this study, it was not significant, and it could be because of their health literacy, or they are aware of the side effects of taking multiple medication concurrently.

This study was essential for advancing future research, particularly for those working in clinical practice and the medical field. In this study, we emphasized that the presence of multiple illnesses serves as a significant predictor among various factors. We anticipate that in the future, physicians will have the opportunity to take part in face-to-face or virtual sessions with patients who are at a heightened risk of having multiple comorbidities or even those who are likely to require more than five medications due to their health conditions. Moreover, healthcare providers must remain aware of their patients' conditions to ensure that individuals are not prescribed medications that could potentially be detrimental to their health. This study presents certain limitations, specifically the absence of data regarding the types of comorbidities experienced by respondents, as well as the names and strengths of the medications they are prescribed. This type of information would enhance the comprehensiveness of the research. Summerised comparison is tabulated in Table 3.

Table 3: Comparison of Polypharmacy Prevalence and Determinants in Malaysia and Other Countries

Country / Region	Prevalence (%)	Key Predictor Identified	Source
Malacca, Malaysia	41.5	Multimorbidity, male gender, unemployment	Present study
Malaysia (urban)	45-52	Multimorbidity, female gender, age ≥ 65	Midão et al. (2018)
Singapore	48-55	Multimorbidity, older age, hospitalization	Ho et al. (2023)
Thailand (urban)	70	Chronic disease, hospital-based treatment	Wongpakaran et al. (2018)
South Korea	82	Multimorbidity, male gander	Kim at al. (2014)

Switzerland	11.8	Age ≥85, multimorbidity	Khezrian et al. (2020)
United State	36-57	Multimorbidity, lower income, older age	Charlesworth et al. (2015)
Portugal	44	Lower education, multimorbidity	Pereira et al. (2017)
Jordan	39-46	Low education, chronic conditions	Majewski et al. (2024)

6. Conclusion

This study found a 41.5% prevalence of polypharmacy in Malacca, highlighting it as a significant public health issue. Key factors associated were non-prescribed medication use, multiple illnesses, employment status, and education level, with multiple illnesses being the strongest predictor. These results emphasise the need for awareness among patients, pharmacists, and healthcare providers to reduce risks. Regular medication reviews and patient education, especially for those with chronic conditions and older adults, are essential. Increase access to health information, targeted interventions can help prevent unnecessary or harmful medication use, improving patient safety and optimising treatment outcomes.

Ethics Approval and Consent to Participate

The research complied with UiTM Research committee prior to data collection. Informed consent was obtained from all participants who were ascertained of their anonymity with their response kept strictly confidential.

Funding

This study received no funding.

Conflict of Interest

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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