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Pharmaceutical Product Selection Decision's SEM Model, based on the Drug's Safety, Efficacy, and Economic Variables

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Abstract

The study investigates the factors influencing patient-centered pharmaceutical care in India, emphasizing the impact of medication availability, affordability, and prescriber attitudes on patient health outcomes. A Structural Equation Modeling (SEM) approach was utilized to analyze the relationships between direct and indirect variables. The study examined various constructs, such as therapeutic effectiveness, cost-effectiveness, safety, and prescriber satisfaction, to understand their influence on patient factors and health outcomes. The SEM method revealed that medication availability and affordability significantly affect patient health outcomes. Additionally, prescriber attitudes were found to have a substantial impact on patient adherence to treatment regimens, with satisfaction with efficacy being particularly influential.

The findings highlight the importance of improving medication access and affordability to enhance patient-centered care. The study also emphasizes the crucial role of prescriber attitudes in the healthcare delivery process. While the research supports targeted policy interventions, it acknowledges the need for further exploration of systemic barriers and comprehensive policy development. The study concludes that policy reforms focusing on medication availability and affordability, combined with prescriber education, are essential for optimizing patient-centered pharmaceutical care. The insights provided by this research contribute to the ongoing discussion on healthcare improvement and serve as a foundation for future policy-making efforts.

Keywords: Pharmaceutical selection, structured equation modeling (SEM), factor identification, patient-centric approach

Introduction

India, with its large population and diverse socio-economic landscape, faces unique challenges in ensuring that pharmaceutical care is patient-centered, accessible, and affordable (Alanazi et al., 2016; S. Jarab et al., 2024). This study examines the issue of medication selection under the influence of various factors, exploring the multifaceted dimensions of medication accessibility, affordability, and their consequent impact on healthcare outcomes (Garcia et al., 2019). The Indian healthcare system is characterized by a dichotomy of abundance and scarcity while there is a vast

array of medications available, the access to and affordability of these medications vary greatly across different strata of society. The disparity in healthcare financing, the burden of out-of-pocket expenses, and the labyrinthine structure of healthcare delivery create barriers that many patients cannot surmount (Riggs & Ubel, 2014). This study aims to unravel these complexities through a rigorous policy analysis and literature review, guided by a robust methodological framework. By examining the relationship between medication access, affordability, and patient outcomes, this study seeks to illuminate the pathways that lead to improved patient-centered care (Fusco et al., 2023).

The accessibility and affordability of medications are crucial factors that influence patient outcomes along with overall effectiveness of pharmaceutical care in India. A significant portion of the population faces economic constraints in our country, the cost of medication can be a barrier to obtaining necessary treatment. Additionally, the availability of drugs and the information surrounding their use play critical roles in healthcare decisions (Gagnon et al., 2024). This study aims to provide a nuanced understanding of how these factors interplay to shape patient-centered pharmaceutical care. By integrating constructs such as therapeutic effects, cost considerations, safety concerns, and prescriber attitudes, the research offers a comprehensive model of the factors that contribute to patient-centered care (Glegziabher et al., 2022; Kim, 2022).

The research hypotheses are based on the assumption that improved access to and reduced costs of medications will result in enhanced health outcomes. Studies indicate that the perspectives of prescribers and the operational methods of pharmacies play a crucial role in the choice of medications and the consistency of patient compliance. Furthermore, inherent obstacles in the healthcare infrastructure negatively impact the provision of care that is focused on the patient's pharmaceutical needs. (Jimmy & Jose, 2011; Yao et al., 2022).

India is making significant progress towards achieving healthcare superiority, and it is crucial to tackle the existing challenges in the realm of pharmaceutical services. The objective of this research is twofold: to enrich scholarly discussions and to shape policy proposals that could revolutionize the framework of drug availability and cost-effectiveness within the country. This investigation seeks to pave the way for a healthcare infrastructure that is fairer, more effective, and more attuned to the requirements of its beneficiaries.

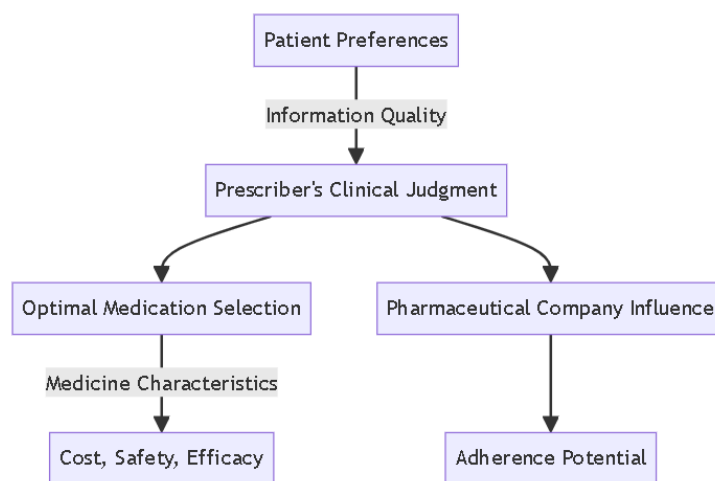


Figure 1: Conceptual model for the effect of factors.

Source: By own

Employing Structural Equation Modeling (SEM), this study examines the intricate interplay to shed light on the routes by which the ease of access to medications and their affordability influences the

health results of patients. (Lee et al., 2021). The findings are expected to inform stakeholders, including policymakers, healthcare providers, and patients, about the critical levers that can be adjusted to improve healthcare services and patient satisfaction in India (Yun & Cho, 2021).

In this area of work our study is trying to explore the effect of key variables which influence the patient health outcome and thereby influence the medication selection process at the system level like how safety, efficacy, cost along with prescriber attitudes and pharmaceutical company practices impact the medication selection in a hospital or medicine supply system.

Based on the literature review, a gap is identified in this area to streamline and structure the process of pharmaceutical selection which can be used in health programs or at policy level and even at formulary level. The objectives of this study are as follows:

Objectives

1. To examine the factors that influence medication selection.
2. To understand the decision-making process of healthcare professionals regarding medication.

Hypotheses

The hypothesis for the study is to find the relation between the tested variables under the study. Describing through the null hypothesis: There is no relation between the variables of medication selection and the outcome of decision making. With p values less than 0.05 as significant level, if p-value was not found below given level through test of significance, we may go to alternative hypothesis for the relation between the variables.

Methodology

Study focussed upon the perception of the health care professionals towards medicine and compared it with that of the basic nature of medicine like their safety profile, cost, and efficacy. To examine this the data was collected using semi structured tool through health care professionals (HCPs). Data was examined for its reliability and validity at different levels. Test of significance was applied to access the effect of key variables.

Data Collection

Data collection was conducted via a comprehensive survey, meticulously crafted to gauge a spectrum of constructs pivotal to patient-centered pharmaceutical care. The instrument encompassed a variety of items aimed at evaluating therapeutic outcomes, economic considerations, safety issues, sources of information, patient accessibility, adherence determinants, healthcare provider perspectives, drug attributes, pharmaceutical industry impact, and decision-making frameworks (Chewning & Sleath, 1996; Kvarnström et al., 2021).

The survey encapsulated scoring variables pertinent to medication selection, derived from the insights of sampled 828 healthcare professionals. These individuals are actively engaged in the domain of medication selection, bearing responsibility for one or more of the following elements: formulary management, health system integration, clinical operations, and pharmacy services.

Healthcare professionals provided ratings for each item, reflecting their practical usage and comprehension of the associated variables. The survey execution employed a semi-structured questionnaire as the investigative tool, reaching out to Tier 1, Tier 2, and Tier 3 cities across India. The process was facilitated by adeptly trained interviewers, ensuring the integrity and precision of the data gathered. Following digitization and cleaning of data, it was analyzed to obtain results of structured equation modeling (SEM) using different models (Dong et al., 2018).

The evaluation of the measurement model was conducted through Confirmatory Factor Analysis (CFA) within the Structural Equation Modeling (SEM) structure. (Kimiaimehr et al., 2020) The assessment involved multiple indicators for each construct, and a set of standards were employed to determine the constructs' reliability and validity. (Cheung et al., 2023) The examination of the structural model focused on evaluating the interrelations among constructs. The analysis involved calculating standardized path coefficients to ascertain the magnitude and orientation of these interconnections. The importance of each pathway was gauged using p-values, with paths deemed statistically significant at a p-value threshold of less than 0.001. (Inotai et al., 2018).

Hypotheses were formulated based on the theoretical framework and were tested using the SEM results. The hypotheses examined the impact of efficacy, safety, cost, information, patient factors, adherence, prescriber attitudes, drug characteristics, and pharmaceutical company influence on patient-focused (PF) and system-focused (SF) outcomes, as well as decision-making (DM) processes.

Result and discussion

The results indicated that most paths in the model were significant, suggesting strong relationships between the constructs. Notably, the path from pharmaceutical company influence to system-focused outcomes was not significant, indicating that this factor may not have a substantial impact on the system-focused aspects of patient-centered pharmaceutical selection. The Structural Equation Modeling (SEM) analysis provided a comprehensive understanding of the relationships between various constructs related to patient-centered pharmaceutical care. The standardized path coefficients indicate the strength and significance of these relationships. Patient-focused (PF) Outcomes were significantly influenced by 'Efficacy' = 0.708, 'Safety' = 0.661, and 'Cost' = 0.667. System-Focused (SF) Outcomes were significantly affected by 'Information' = 0.771 and 'Adherence' = 0.735, while 'Drug' characteristics showed a non-significant impact = 0.044.

Therapeutic effect (0.865): A high coefficient suggests that the therapeutic effect is a primary concern in decision-making, heavily influencing the selection of pharmaceuticals. Consider the cost-effectiveness (1.081): This variable stands out with the highest coefficient, indicating that cost-effectiveness is a critical factor and greatly impacts the selection process. Duration of action (0.952): A high value here implies that how long a medication works is a significant consideration for healthcare professionals. Cost-effectiveness has an unusually high standard coefficient compared to others, which is a peculiarity indicating its strong influence on decision-making. Another peculiarity is the variable "Seek parallel opinions for consultation," which has a much larger standard error than the rest, yet it remains significant, suggesting that while it's a less stable predictor, it's still an important factor in the decision-making process.

Awareness of prescribing alternatives (0.297): Although still significant, this lower coefficient indicates that while awareness of alternatives is considered, it may not be as influential as other factors. Risk of dependence/addiction (0.488): A lower coefficient here suggests that while the risk of dependence or addiction is a concern, it may not be as heavily weighted as other factors like efficacy or cost. The indicated variables are pivotal in the decision-making process, suggesting that they are the most influential factors when selecting pharmaceuticals. Their high coefficients mean that any change in these variables will have a substantial impact on the decision-making outcome. The variable Satisfied with efficacy appears twice with different coefficients, indicating possibly different aspects or measurements of efficacy satisfaction being considered.

The results indicate that most of the listed variables have a statistically significant impact on the decision-making process for selecting pharmaceuticals, with particular emphasis on therapeutic

effect, cost considerations, and the need to stay updated with current information. The high Z values and very low p-values across all variables reinforce the robustness of these findings.

Table 1: Standard equation modeling result for selection model

Variable	Std. coeff.	SE	Z value	p-value	Result
Therapeutic effect	0.865	0.034	23.208	< 0.001	Significant
Onset of action	0.807	0.034	22.071	< 0.001	Significant
Dose frequency	0.77	0.034	21.105	< 0.001	Significant
Consider the cost-effectiveness	1.081	0.054	19.753	< 0.001	Significant
Discussed the cost of the medication	0.693	0.024	23.084	< 0.001	Significant
Cost-effectiveness	0.843	0.06	14.186	< 0.001	Significant
Challenges for Selecting medication	0.648	0.043	14.979	< 0.001	Significant
Adverse effects of the medication	0.586	0.042	13.61	< 0.001	Significant
Pharmacology of the medication	0.766	0.047	16.275	< 0.001	Significant
Stay up to date	0.92	0.054	16.4	< 0.001	Significant
Sources of information for decision making	0.638	0.036	15.812	< 0.001	Significant
Therapeutic index of the medication	0.673	0.038	16.547	< 0.001	Significant
Medication availability	0.747	0.046	22.578	< 0.001	Significant
Factors influence prescribing	0.812	0.045	24.988	< 0.001	Significant
Affordability for patients	0.697	0.046	20.776	< 0.001	Significant
Satisfied with efficacy	0.758	0.031	20.67	< 0.001	Significant
Risk of allergic reactions	0.546	0.029	14.971	< 0.001	Significant
Risk of dependence/addiction	0.488	0.028	13.407	< 0.001	Significant
Duration of action	0.952	0.039	21.766	< 0.001	Significant
Seek parallel opinions for consultation	0.878	0.151	5.951	< 0.001	Significant
Awareness of prescribing alternatives	0.297	0.044	7.007	< 0.001	Significant
Satisfied with efficacy	1.654	0.292	6.627	< 0.001	Significant
Promotions by pharma	1.181	0.205	6.634	< 0.001	Significant
Availability	0.676	0.046	17.012	< 0.001	Significant
Dosage form	0.609	0.051	14.842	< 0.001	Significant
Influence of pharmaceutical companies	0.629	0.048	15.42	< 0.001	Significant
decision making for prescribing	0.571	0.05	15.27	< 0.001	Significant
decision making for alternative	0.647	0.046	17.506	< 0.001	Significant
decision associated selection	0.721	0.055	19.597	< 0.001	Significant

The findings suggest that by improving the ease of access to medications and making them more affordable, coupled with the enhancement of information for both prescribers and patients, we can achieve superior outcomes centered around the patient. The lack of a significant connection from the 'Drug' characteristics to the outcomes focused on the system implies that there may be other elements that are more crucial in shaping these outcomes.

The outcomes of our research offer a straightforward and detailed comprehension of how the variables related to selecting medications interrelate. The application of standardized path coefficients provides a straightforward grasp of the intensity of the connections between the constructs.

Discussion

The insights derived from the Structural Equation Modeling (SEM) analysis shed light on the intricacies of patient-focused pharmaceutical care in India. The discussion here deciphers the

findings within the framework of the study's goals and theoretical propositions, weaving a story that connects the concrete data to the wider consequences for health policy and clinical application.

Impact of Medication Accessibility and Affordability

The pronounced links between the ease of obtaining medications and their affordability with the health results of patients highlight the essential part these elements play within the healthcare framework. The affirmative path coefficients for 'Medication availability' =0.747, and 'Affordability for patients' =0.697, resonate with the initial hypothesis, proposing that enhanced medication access could foster improved health outcomes. This observation is in harmony with existing research that underscores the obstacles encountered by individuals in regions with lower economic resources, where the expense and accessibility of drugs can be limiting.

Influence of Prescriber Attitudes

Furthermore, the research uncovered that the mindsets of prescribers have a substantial effect on how well patients stick to their treatment plans, corroborating the third hypothesis. The constructs associated with 'Prescriber' attitudes, such as 'Satisfaction with efficacy' =1.654, suggest that prescribers content with the effectiveness of medicines are more inclined to positively steer patient adherence. This infers that the convictions and insights of prescribers are critical in determining the success of treatments.

Implications

Our study's implications lie in establishing relationships among key variables and medication selection. We propose a structured approach to integrate these insights into medication selection systems, whether at the policy level within organizations or health systems. By offering a framework that assigns weights to medication-related variables based on their influence, our model can inform decision-making processes and enhance understanding of medication applicability.

Systemic Barriers and Policy Recommendations

The study's findings, though not explicitly tackling systemic obstacles or outlining particular policy measures, suggest the presence of such hindrances that warrant attention. The substantial path coefficients highlight potential zones for policy action. For example, boosting the affordability of medications might be realized through financial aid or regulatory pricing measures, whereas enhancing their availability could necessitate alterations in the logistics of distribution or the framework of healthcare services.

Conclusion

The study's findings highlight the importance of medication accessibility and affordability for patient-centered pharmaceutical care in India. The influence of prescriber attitudes on patient adherence also emerges as a key factor. The study successfully assessed the impact of medication accessibility and affordability on patient health outcomes. The significant path coefficients for 'Medication availability' and 'Affordability for patients' confirmed that these factors are crucial determinants of health outcomes in India.

The influence of prescriber attitudes on medication selection and patient adherence was demonstrated. The data revealed that prescribers' satisfaction with medication efficacy significantly affects patient adherence, highlighting the role of prescriber perceptions in treatment outcomes. Policy interventions aimed at improving medication accessibility and affordability are imperative for enhancing patient-centered pharmaceutical care in India. The study also calls attention to the importance of prescriber education and the need for policies that support informed decision-making in pharmaceutical care. While the study made significant strides in addressing these objectives and

hypotheses, it also acknowledged the existence of systemic barriers that were not directly examined. These barriers, along with the need for evidence-based policy recommendations, remain areas for future exploration.

These insights pave the way for targeted policy interventions that could significantly improve healthcare outcomes in the country. The study contributes to a growing body of knowledge that seeks to inform and transform healthcare delivery in India. By highlighting the key factors that influence patient-centered pharmaceutical care, it provides a foundation for policymakers, healthcare providers, and stakeholders to build upon in their efforts to create a more equitable and effective healthcare system. As India continues to evolve its healthcare system, these factors must be considered in the development of strategies aimed at optimizing pharmaceutical care for all patients.

Declaration

We acknowledge the contributions of all individuals and organizations involved in the completion of this study. The collaborative efforts of authors, data analysts, and participants have been instrumental in advancing our understanding of medication selection processes.

Contribution

This paper represents a culmination of collaborative efforts aimed at enhancing our understanding of medication selection processes through the application of Structural Equation Modeling (SEM). Each contributor has played a vital role in shaping the direction and outcomes of this research endeavor.

Conflict of interest

None

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Bibliography

1. Alanazi, A. S., Alfadl, A. A., & Hussain, A. S. (2016). Pharmaceutical Care in the Community Pharmacies of Saudi Arabia: Present Status and Possibilities for Improvement. *Saudi Journal of Medicine & Medical Sciences*, 4(1), 9. <https://doi.org/10.4103/1658-631X.170881>
2. Cheung, G. W., Cooper-Thomas, H. D., Lau, R. S., & Wang, L. C. (2023). Reporting reliability, convergent and discriminant validity with structural equation modeling: A review and best-practice recommendations. *Asia Pacific Journal of Management*, 1-39. <https://doi.org/10.1007/S10490-023-09871-Y/TABLES/7>
3. Chewning, B., & Sleath, B. (1996). Medication decision-making and management: A client-centered model. *Social Science & Medicine*, 42(3), 389-398. [https://doi.org/10.1016/0277-9536\(95\)00156-5](https://doi.org/10.1016/0277-9536(95)00156-5)
4. Dong, W., Liu, S., & Fang, Z. (2018). On modeling mechanisms and applicable ranges of grey incidence analysis models. *Grey Systems: Theory and Application*. <https://doi.org/10.1108/GS-04-2018-0019>
5. Fusco, N., Sils, B., Graff, J. S., Kistler, K., & Ruiz, K. (2023). Cost-sharing and adherence, clinical outcomes, health care utilization, and costs: A systematic literature review. *Journal of Managed*

- Care and Specialty Pharmacy, 29(1), 4-16.
<https://doi.org/10.18553/JMCP.2022.21270/ASSET/IMAGES/FIG3.JPG>
6. Gagnon, J., Breton, M., & Gaboury, I. (2024). Decision-maker roles in healthcare quality improvement projects: a scoping review. *BMJ Open Quality*, 13(1), 2522. <https://doi.org/10.1136/BMJOQ-2023-002522>
 7. Garcia, M. M., Barbosa, M. M., Silva, R. M., Reis, E. A., Alvares, J., De Assis Acurcio, F., Godman, B., & Junior, A. A. G. (2019). Indicator of access to medicines in relation to the multiple dimensions of access. *Journal of Comparative Effectiveness Research*, 8(12), 1027-1039. https://doi.org/10.2217/CER-2019-0031/SUPPL_FILE/SUPPL_FILE.DOCX
 8. Glegziabher, R., Biks, G. A., Dellie, E., Worku, N., & Endalew, B. (2022). <p>Patient-Centered Care and Associated Factors among Adult Admitted Patients in South Wollo Public Hospitals, Northeast Ethiopia</p>. *Patient Preference and Adherence*, 16, 333-342. <https://doi.org/10.2147/PPA.S346000>
 9. Inotai, A., Brixner, D., Maniadakis, N., Dwiprahasto, I., Kristin, E., Prabowo, A., Yasmina, A., Priohutomo, S., Németh, B., Wijaya, K., & Kalo, Z. (2018). Development of multi-criteria decision analysis (MCDA) framework for off-patent pharmaceuticals – An application on improving tender decision making in Indonesia. *BMC Health Services Research*, 18(1). <https://doi.org/10.1186/s12913-018-3805-3>
 10. Jimmy, B., & Jose, J. (2011). Patient Medication Adherence: Measures in Daily Practice. *Oman Medical Journal*, 26(3), 155. <https://doi.org/10.5001/OMJ.2011.38>
 11. Kim, M. (2022). The Factors Associated with Person-Centered Care Competence among Nursing Students. *International Journal of Environmental Research and Public Health*, 19(5). <https://doi.org/10.3390/IJERPH19052787>
 12. Kimiaeimehr, F., Hosseini, S. M., Alimohammadzadeh, K., Bahadori, M., & Maher, A. (2020). Confirmatory factor analysis model of factors affecting the implementation of clinical guidelines in Iran. *Medical Journal of the Islamic Republic of Iran*, 34, 122. <https://doi.org/10.34171/MJIRI.34.122>
 13. Kvarnström, K., Westerholm, A., Airaksinen, M., & Liira, H. (2021). Factors Contributing to Medication Adherence in Patients with a Chronic Condition: A Scoping Review of Qualitative Research. *Pharmaceutics*, 13(7). <https://doi.org/10.3390/PHARMACEUTICS13071100>
 14. Lee, K. S., Kassab, Y. W., Taha, N. A., & Zainal, Z. A. (2021). Factors Impacting Pharmaceutical Prices and Affordability: Narrative Review. *Pharmacy: Journal of Pharmacy Education and Practice*, 9(1), 1. <https://doi.org/10.3390/PHARMACY9010001>
 15. Riggs, K. R., & Ubel, P. A. (2014). Overcoming Barriers to Discussing Out-of-Pocket Costs With Patients. *JAMA Internal Medicine*, 174(6), 849. <https://doi.org/10.1001/JAMAINTERNMED.2014.853>
 16. S. Jarab, A., Muflih, S., Almomani, R., Abu Heshmeh, S., Abu Hammour, K., L. Mukattash, T., Al-Qerem, W., & Alefishat, E. A. (2024). Hospital pharmacists' knowledge, attitudes and practice of pharmaceutical care and the barriers for its implementation at the hospital setting. *Heliyon*, 10(8), e28227. <https://doi.org/10.1016/J.HELIYON.2024.E28227>
 17. Yao, S., Lix, L. M., Teare, G., Evans, C., & Blackburn, D. F. (2022). Physician influence on medication adherence, evidence from a population-based cohort. *PLOS ONE*, 17(12). <https://doi.org/10.1371/JOURNAL.PONE.0278470>
 18. Yun, J. Y., & Cho, I. Y. (2021). Structural Equation Model for Developing Person-Centered Care Competency among Senior Nursing Students. *International Journal of Environmental Research and Public Health*, 18(19), 10421. <https://doi.org/10.3390/IJERPH181910421>