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Research Paper

Medical staff perspective on factors influencing their prescribing decisions: a cross-sectional study in Mekong Delta, Vietnam

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Abstract

Objectives Understanding medical staff's prescription behaviors helps improve the quality of prescriptions and the rationality of medication use. Although factors affecting the prescribing decisions were discussed in various studies worldwide, limited knowledge of these issues has been reported in Vietnam. This paper aims to examine factors that influence prescribing behavior concerning medical staff's demographics and characteristic differences.

Methods Quantitative descriptive cross-sectional study, using adapted questionnaire consisting of 27 factors divided into 9 factor categories, was conducted with medical staff in Mekong Delta during June–July, 2019. Rasch analysis was performed to assess the questionnaire psychometric properties. Descriptive analysis, parametric tests and non-parametric tests were utilized to address the study objectives.

Key findings A total of 201 participants completed the questionnaire. A majority of participants (>90%) agreed that their own decision to prescribe a drug was influenced by several factors such as drug safety and efficacy (92.5%), patient history (92.0%), patient income (92.0%) and patient disease status (91.0%). There were significant age differences in influences on prescribing decision. Medical staff aged under 30 appreciated the role of pharmacists higher than whose aged 31–40 (*P*-value = 0.010) and over 40 (*P*-value = 0.013). Additionally, they were more concerned with 'patient characteristics' including patient request, expectations, and disease status when making prescribing decisions compared with whose aged over 40 (*P*-value = 0.005).

Conclusions The study revealed various factors influencing medical staff prescription decision-making processes. These findings could be useful for pharmaceutical companies in

Vietnam in developing marketing strategies, and for policy-makers in timely improvement of prescription quality.

Keywords: medical practitioners; prescribing decision; Mekong Delta; Vietnam

Introduction

In Vietnam, an economic reformation process known as 'Doi Moi' (literally means 'renovation'), initiated in 1986, had a positive impact on the overall development of the country.[1] Along with this process, the healthcare sector transited from a centrally-planned to a market-oriented system. Furthermore, liberalization of the pharmaceutical market and legalization of the private healthcare sector was established.[2] Based on the General Statistics Office of Vietnam, the total number of healthcare facilities in Vietnam increased significantly, which reached a number of 13 583 in 2017, including 1085 hospitals, 579 regional polyclinics, and 11 830 medical service units in communes, wards, offices and enterprises.[3] Regarding the pharmaceutical sector, due to the country opening to foreign trade, from 2011 to 2015, Vietnam was one of the fastest pharmaceutical industry development countries in Asia,[4] with a total value of $3.81 billion in 2014.[5] Vietnam is estimated to have a compound annual growth rate of 8%, and rank 8th among pharmerging countries by 2022.[6] Prescription drugs accounted for the highest proportion in Vietnam's pharmaceutical market, with 73.7% of total sales and $2.8 billion revenue in 2014, based on Business Monitor International Ltd (BMI) data.[5] This number is expected to significantly increase and will reach over 87% by 2024.[5]

One of the main growth drivers of the prescription medicines market in Vietnam is environmental and demographic trends, including air and water pollution, population aging, disease characteristics and customer needs.[5] For example, air pollution might lead to an increase in the number of cardiovascular and respiratory diseases,[7] thus, increasing the need for prescription drugs of these particular diseases. Besides these drivers, prescribers play an important role as a bridge between drug suppliers and consumers to legalize the drug purchasing of patients, as prescription drugs require legal medical prescriptions to be dispensed. Moreover, as stated by Al-Areef,[8] medical staff medicine prescribing were affected by multiple forces including pharmacy and non-pharmacy factors.

Worldwide, various studies have been reported on factors related to medical staff's decision on drug prescription. For instance, studies in the USA showed that the important factors influencing physicians' prescribing decisions include drug safety, effectiveness, formulary status,[9] policies restricting drug use,[10] pharmacists recommendations, pharmacists' competency,[11] pharmaceutical industry,[12, 13] scientific paper, own training and clinical experience.[12] Studies on prescribing behavior in the United Kingdom also identified the key role of other several factors such as organizational prescribing 'cultures', informal 'benchmarking' within peer networks,[14] considerations of the doctor-patient relationship,[15, 16] patients' expectations,[17] patient request, patient convenience and acceptability,[18] side effects of drugs, the cost of drugs.[19] In Sweden, qualitative studies found a few other important factors such as colleagues and therapeutic tradition at the hospital or clinic,[20] professional and national guidelines, prescriber's knowledge, and patient's level of disease activity.[21] Aside from common factors like clinical situation, advance care plans, utilization of diagnostic resources, physicians' perceived risks and environmental factors (a study in the Netherlands),[22] other factors including pharmaceutical delivery mode, recommended daily dose, physician's age, patients' insurance coverage and income (in Greece),[23, 24] payers' related factor (in Iran),[25] severity of symptoms, and patients' intolerance of side effects, and efficacy (in Singapore)[26] were found to effect on drug choice.

Some of the current problems associated with drug prescribing in Vietnam include polypharmacy and overuse of antibiotics. A study of the prescription patterns found that Vietnam had the highest rate of polypharmacy (59.1%) among Asian countries.[27] Mao *et al*. found that overuse of antibiotics, antibiotics usage with wrong course and polypharmacy were severe issues in Vietnam.[28] Although Vietnam is facing many problems of inappropriate prescription, there is a lack of effective regulation and control mechanisms for prescribing.[29] Additionally, a previous study has confirmed that one of the most urgent issues in the Vietnamese healthcare system is the high medicine prices due to the corruption practices in drug prescription.[2] This corruption is mostly related to the medical staff, which are controlled by the thriving economy. Thus, to understand and improve the situation, investigation of factors affecting the prescription decision-making processes is crucial.

Physician prescribing is fundamental to their scope of practice.[30] Although issue related to factors affecting prescribing decision was implemented in various studies worldwide,[9–26] to the best of our knowledge, there have been no studies conducted on this issue in the context of Vietnam. Most studies in Vietnam have focused on doctors' prescribing behavior based on analysis of different parameters on their prescriptions such as prescribed drugs number, average prescription cost, proportion of generic drugs, antibiotics, corticosteroids, vitamins and essential drugs.[31–34] It can be seen that factors behind their prescribing decisions are not well understood in the context in Vietnam. Why medical staff prefers to choose one drug over another in a therapeutic drug group is less well known. Additionally, understanding medical staff's prescription behaviors could help promoting the development of the prescription drug market, and improving timely intervention to enhance the quality of prescriptions and the rationality of medicine use. For example, knowledge from the study could be useful for pharmaceutical companies to choose effective sales promotion strategies for marketing success. Lastly, information from this investigation might shed light on the important decisions and priority investments of policy makers and educators to identify the measures needed for improving the Vietnamese healthcare sector. For instance, if the study shows prescription behavior of medical staff is influenced by pharmacist factors, pharmacist intervention should be then considered to improve medical staff prescribing, as the effectiveness of pharmacist intervention on medical staff prescribing and patient outcomes has been confirmed.[35, 36]

Therefore, our present research aims to explore several factors that might influence the prescription decision-making processes concerning medical staff's demographics characteristics differences to provide a holistic picture of their drug prescription behavior in all 13 provinces and cities in the Mekong Delta, Vietnam, in 2019. A quantitative descriptive cross-sectional study was utilized with an adapted questionnaire to quantify the factor influences (Likert scale 1–5). Rasch analysis was conducted to verify the model validity and reliability. Descriptive

statistics, *t*-test, one-way ANOVA (or Kruskal Wallis), Post hoc Tukey tests (or Mann–Whitney) were used to address the study objectives. Finally, the analytical results, possible underlying reasons, and practicable interventions for policy-makers were discussed.

Method

Study design and sample

A quantitative descriptive cross-sectional study was used in this study design. Participants were selected using the convenience sampling method through a public medical university in the Mekong Delta, where they participated in a continuous training course. During the study period from June to July, 2019, the public medical university conducted 12 courses. All participants (410) of 12 courses were invited to participate in the study. This study included participants from all provinces in the Mekong Delta. Participants from other regions were excluded. The Mekong Delta, located in southwestern of Vietnam, is the largest delta in the country, and the world's third largest delta[37] with a dense population of 17.7 million.[38] The region comprises of 13 provinces and cities: Can Tho, Long An, Tien Giang, Ben Tre, Tra Vinh, Vinh Long, Dong Thap, An Giang, Kien Giang, Hau Giang, Soc Trang, Bac Lieu and Ca Mau. Ethical approval was obtained from the ethics council of the Can Tho University of Medicine and Pharmacy, Can Tho city, Vietnam (approval code: 100/HĐĐĐ-PCT).

Survey instrument

During the investigation, a printed self-administered questionnaire was delivered individually to all participants. In this study, domains and their respective items of the questionnaire were developed based on adaptation of previous published model of prescribing decisions by Murshid (2017; 2019).[39, 40] The advantages of this model include the new update and combination of existing methods and previous models of prescribing behavior. From the above literature review in the introduction, it is evident that this model contains the majority of important factors, which have the potential to cover all possible aspects relating to prescribing behavior. Therefore, the model may be helpful as a framework for examining influence of factors on the medical staff decision-making process in developed and developing countries,[12] including Vietnam. The questionnaire consisted of 27 items (factors) influencing the drug selection decisions, and was divided into 9 domains (factor categories), including information available on a drug, brand of a drug, sales promotion, patient characteristics, pharmacist factors, drug characteristics, cost/benefit ratio of a drug, medical staff habit persistence and professional principle. Each domain contains an equal number of 3 items. Each item was assessed based on the five-point Likert scale (1 – Strongly disagree; 2 – Disagree; 3 – Neutral; 4 – Agree; 5 – Strongly agree). For the purpose of explanation of responses to individual items, responses of 'strongly disagree' and 'disagree' were combined and discussed as 'disagree'. Similarly, responses of 'strongly agree' and 'agree' were combined and discussed as 'agree'. In addition, demographic questions such as gender, age, education, experience, places of working and income were also included in the questionnaire.

Questionnaire validity and reliability

Due to the fact that the questionnaire was constructed based on previous models of prescribing decisions, the use of data reduction methods, namely exploratory factor analysis, and principal components analysis may not be necessary for the current study.[41] Therefore, the 'fit' of the model was checked using Rasch analysis with Rating scale model. Item fit statistic including the Infit and Outfit mean-square (NMSQ) values, and the point-measure correlation (PTMEA Corr) coefficient were used to examine the validity of the questionnaire. Infit and Outfit NMSQ were used to evaluate how well each item contributes to the instrument measurement. Items possessing these values between 0.6 and 1.5 were accepted.[42] A positive value of PTMEA corr indicates that the items are moving in the same orientation with the construct.[43] According to Linacre, 0.3–0.7 was considered acceptable values of PTMEA Corr.[42]

Moreover, to assess the internal consistency of the questionnaire structure, item reliability and item separation index of each domain and of the overall questionnaires were measured using Rasch model. Item reliability indicates the ability to reproduce the item difficulty for different groups of participants with comparable capabilities.[44] The value greater than 0.7 was considered acceptable level of item reliability.[45] The item separation index reflects the ability of the questionnaire to distinguish between items with varying levels of difficulty.[46] The value of item separation index greater than 2.0 is considered good.[45] A sample with at least 100 participants is required to perform Rasch analysis.[47]

Data analysis

The collected data were analyzed using jMetrik version 4.1.1 for the Rasch analysis and IBM SPSS Statistics software 20.0 for testing hypotheses, descriptive statistics. Descriptive statistics including frequency (percentage, %), mean (standard deviation, SD), median (interquartile range, IQR) and range (min–max) were used to present categorical and continuous variables. The normality of the data was first checked using skewness, kurtosis values and Q–Q plot. After confirming normality, parametric assumptions were tested to guide selection of parametric tests or non-parametric for hypothesis testing. The *t*-test, one-way ANOVA (or Kruskal Wallis test, when data normality and parametric assumptions were not satisfied) were performed to find out the differences between groups of participants categorized according to their demographic characteristics. If significant differences were found, Post hoc Tukey (or Mann–Whitney tests, when data normality and parametric assumptions were not satisfied) were then utilized. Significant differences were determined when the *P*-value was less than 0.05.

Results

Demographic characteristics

Of 410 distributed questionnaires, 269 questionnaires were successfully retrieved with a survey response rate of 65.6%, of which 47 were not from the Mekong Delta and 21 left all items of the questionnaire blank. Therefore, 68 participants were excluded and only 201 participants were included in the final data analysis. Demographic characteristics of participants (N = 201) in this study are presented in Table 1. The mean (SD, range) age and experience of medical staffs were 33.40 years (6.67, 21 to 53 years), 8.69 years (5.67, 2 to 38 years), respectively. Most of them were male (64.7%), physician assistant (72.1%), and worked in Can Tho city (18.4%).

Validity and reliability of the questionnaire

The sample size of 201 in this study was considered as appropriate for conducting Rasch analysis. The results of assessing the validity and reliability of the questionnaire are shown in Tables 2 and 3. For each domain, most items had a positive PTMEA Corr value

Table 1 Participant demographic data

Demographics (*N* = 201)		Frequency (*n*)	Percent (%)
Gender	Male	130	64.7
	Female	71	35.3
Age (years)	21–30	100	49.8
	31–40	64	31.8
	40+	37	18.4
Education	Physician assistant[a]	145	72.1
	Physician[b]	56	27.9
Experience (years)	1–5	66	32.8
	6–10	84	41.8
	10+	51	25.4
Place of working (provinces/cities of the Mekong Delta)	Can Tho	37	18.4
	Long An	14	7.0
	Tien Giang	14	7.0
	Ben Tre	6	3.0
	Tra Vinh	7	3.5
	Vinh Long	10	5.0
	Dong Thap	13	6.5
	An Giang	18	9.0
	Kien Giang	21	10.5
	Hau Giang	15	7.5
	Soc Trang	11	5.5
	Bac Lieu	13	6.5
	Ca Mau	22	11.0
Income (VND million/ month)[c]	<4.2	104	51.7
	4.2–8.3	43	21.4
	≥8.4	34	16.9

[a]Medical staff who graduated 2- or 3-year program in medical education; [b]4- or 6-year program in medical education; [c]20 (10%) missing values. VND 4.2 million ≈ USD 180.

(0.30–0.56), indicating adequate correlation with the measurement constructs. Only two items (Scientific evidence from clinical studies about the medicine; Drug safety and efficacy) fall outside the proposed value range of 0.3–0.7. Additionally, for all items, range of Infit MNSQ values (0.69–1.32) and range of Outfit MNSQ values (0.71–1.35) were within acceptance limits. All nine domains had item reliability values between 0.71 and 0.99, indicating acceptable internal consistency in each domain. The separation index of all domains ranged from 2.41 to 13.83, with an exception for the domain 'Cost/Benefit Ratio of a Drug' (1.60), suggesting good discriminatory and distinction ability in domains.

Influences on prescription decision

Table 4 shows responses to questions related factors that influence on prescription decisions. From the analysis result of each individual item, a high proportion of participants agreed that their prescribing process was influenced by factors such as drug safety and efficacy (92.5%), patient history (92.0%), patient income (92.0%), patient disease status (91.0%), scientific evidence (88.6%), local treatment guidelines (88.6%), experiences of other medical staff (87.6%), side effects (86.1%), good reputation and reliable brand (86.1%), drug price (84.1%).

For each of the nine domains, we conducted further study to identify the differences between participant groups classified by demographics regarding gender, age, education, experience (see Tables 5 and 6). Participants of different age-groups were significantly influenced by 'pharmacist factors' (P = 0.007) and 'patient characteristics' (P = 0.007). There were significant differences on experience in impact of 'brand of a drug' (P = 0.049) on medical staff's prescribing decision. A variety of factors such as 'pharmacist factors' (P = 0.001), 'patient characteristics' (P = 0.007) and 'sales promotion' (P = 0.002) were found to have significant effects on participants of different income-groups. Results from Post hoc Mann–Whitney test showed that medical staff under 30 years old appreciated the role of pharmacists higher than whose aged 31–40 (P = 0.010) and over 40 (P = 0.013). Post hoc Tukey results showed that medical staff under the age of 30 considered 'patient characteristics' as a more important factor than staff aged over 40 (P = 0.005). Furthermore, medical staff with less than 5 years of experience rated factor 'brand of a drug' higher than staff with 6–10 years of experience (P = 0.045). 'Pharmacist factors', 'patient characteristics' and 'sales promotion' were more influential on prescribers with lower incomes (<VND 4.2 million) than other income groups.

Discussion

This study identified a variety of factors that influence medical staff's prescription decisions. According to the study results, a large percentage of participants agreed that 'cost and benefit ratio' domain, including 3 items, history interferes (92.0%), the income of the patient (92.0%) and drug price (84.1%), influenced their prescribing process. Similar findings were also reported by Kisa,[48] Ferdoush *et al.*[49] and Theodorou *et al.*,[24] which showed that the cost of the drug and patient's economic level were assessed as important by the majority of prescribers. Our results were different from studies by Prosser *et al.*,[18] Kamuhabwa and Kisoma[50] and Al-Areef,[8] where a low percentage of prescribers were affected by history interferes and cost to the patient. Additionally, prescription patterns of the majority of medical staff were altered by 'drug characteristics' related factors, such as drug efficacy, safety (92.5%) and side effects (86.1%). This finding is in keeping with previous studies of Theodorou *et al.*,[24] Kamuhabwa and Kisoma,[50] Prosser *et al.*,[18] Tan *et al.*[26] and Bradley *et al.*[19]

Besides 'cost and benefit ratio of a drug' and 'drug characteristics', the factor 'professional principle' was also emphasized by a high number of prescribers. Over 80% of the participants were influenced by the national and local treatment guidelines. Similar to the findings of Prosser *et al.*[18] and Kalkan *et al.*,[21] which showed that national treatment guidelines and local guidelines are of importance in decision-making. The guidelines are one of the foundations of efforts based on the scientific evidence to improve healthcare.[51] The application of guidelines by medical staff in Vietnamese clinical practice could improve prescribing quality and reduce prescription errors for patients in the Mekong Delta. Moreover, high attention of medical staff to the medicine cost could bring potential economic benefits to these people. In Vietnam, a majority of people participate in health insurance with a population coverage rate of about 90%, according to 2020 data.[52] Therefore, for ensuring minimum out-of-pocket payments for healthcare services among patients, prescribers should prioritize the selection of drugs covered by health insurance. In addition, for the therapeutic drug group, prescribers should choose drugs with competitive prices, but should not ignore the factors of drug effectiveness and safety. This is important because the Mekong Delta is one of the regions with low per capita monthly income (VND 3.59 million) compared with other regions, and the whole country (VND 3.88 million), based on data from General Statistics Office of Vietnam (2018).[38]

Table 2 Item fit indices of the instrument

Domain (Factor category)	Item (Factor)	Infit MNSQ	Outfit MNSQ	PTMEA corr
Information available on a drug	Drug information published in medical journals	1.13	1.10	0.33
	Scientific evidence from clinical studies about the medicine	1.28	1.27	**0.26**
	Drug information available on the Internet	0.85	0.88	0.47
Brand of a drug	Drugs that have a brand already been tested by colleagues	1.04	1.07	0.38
	Drugs have a good reputation and reliable brand	1.07	1.06	0.39
	Confidence in drug manufacturer	0.77	0.76	0.52
Sales promotion	Effectiveness of medical representatives	0.74	0.74	0.53
	The free samples of the medicine	0.88	0.90	0.54
	Getting a commission from a drug company when prescribing	1.08	1.09	0.53
Patient characteristics	Patient request for drug	1.32	1.35	0.34
	Patients' current disease status	1.05	1.12	0.30
	Patient expectations	0.96	0.99	0.42
Pharmacist factors	Pharmacists are a reliable source of general drug information	0.90	0.93	0.48
	Recommendation of pharmacists regarding prescribing certain medications from some companies before prescribing	0.71	0.71	0.56
	Pharmacist-medical staff collaboration in managing drug therapy of patients	1.09	1.02	0.53
Drug characteristics	Drug safety and efficacy	1.18	1.30	**0.20**
	Drugs have fewer side effects	1.29	1.34	0.30
	Diversity of drug forms	0.69	0.73	0.56
Cost/benefit ratio of a drug	Drug price interferes with prescription	1.14	1.16	0.33
	Patient history interferes with prescription	0.95	0.99	0.30
	The income of the patient before prescribing	0.89	0.87	0.50
Medical staff habit persistence	Prescribing the same drug that I have had a positive experience with	0.96	1.00	0.40
	Positive clinical experiences of other medical staff with a brand lead to brand loyalty	1.00	1.06	0.41
	Prescribing the same drug that I have had a positive experience with the patient	1.08	1.18	0.41
Professional principle	Local treatment guidelines	0.78	0.75	0.49
	Availability of drugs covered by health insurance	1.14	1.23	0.32
	National treatment guidelines	1.09	1.12	0.38

Bold numbers indicate the PTMEA correlation values fall outside the acceptable range of 0.3–0.7.

Table 3 Reliability test of the questionnaire using Rasch analysis

Domain	Item reliability	Item separation index
Information available on a drug	0.98	9.60
Brand of a drug	0.98	9.80
Sales promotion	0.97	5.78
Patient characteristics	0.99	13.83
Pharmacist factors	0.94	4.02
Drug characteristics	0.97	6.31
Cost/benefit ratio of a drug	0.71	**1.60**
Medical staff habit persistence	0.99	11.68
Professional principle	0.85	2.41
Overall	0.98	8.26

Bold number indicates value lower than good item separation index of >2.0.

Recently, medical staff-pharmacist collaborative practices have changed significantly. Pharmacists play an important role in providing drug information and advices on appropriate prescription to medical staff.[53] Our results on this professional collaboration in Vietnam demonstrated that medical staff highly rated the role of pharmacists in managing drug therapy of patients rather than in providing drug information and advices. These findings are consistent with the results of the study by Kelly *et al.*[54] Furthermore, our data showed that younger medical staff were more influenced by the 'pharmacist factors' in their decision-making process than older ones. The reason behind this probably was because younger medical staff are generally more open[55] and tended to easily accept opinions from other healthcare workers.[56] Another reason was that younger prescribers are likely to be reliant on the pharmacists and consultants because of their limited prescribing experience and lack of confidence in prescribing. Thus, they need guidance from reliable sources for learning of safely and effectively prescribing,[57] and less frequent prescribing errors.[58, 59]

Concerning the impact of the 'drug information' factor category, scientific evidence from clinical studies and drug information from medical journals seemed to have an influence on most staff's decision-making (88.6% and 81.1%, respectively). A similar result was reported in previous research by Kalkan *et al.*,[21] Jones *et al.*[60] and Avorn *et al.*[61] However, these data are in contrast to the pharmacist's point of view. According to research by Moritz *et al.*[62] and Hanna and Hughes,[63] scientific evidence is less routinely considered by pharmacy staff because their primary priority is the desire to meet patients' expectations. From our results, recognition of the importance of scientific evidence by medical staff had a positive impact on their practices of prescribing drugs, thereby improving the quality of prescriptions and better treatment outcomes for patients in the Mekong Delta.

Table 4 Response to questions related factors that influence on prescription decisions

Factor	Disagree[a]	Neutral	Agree[b]	Mean (SD)	
				Domain	Item
Cost and benefit ratio of a drug				4.17 (0.53)	
Patient history interferes with prescription	2 (1.0)	14 (7.0)	185 (92.0)		4.22 (0.61)
The income of the patient before prescribing	5 (2.5)	11 (5.5)	185 (92.0)		4.19 (0.67)
Drug price interferes with prescription	6 (3.0)	26 (12.9)	169 (84.1)		4.09 (0.73)
Drug characteristics				4.13 (0.51)	
Drug safety and efficacy	2 (1.0)	13 (6.5)	186 (92.5)		4.39 (0.66)
Drugs have fewer side effects	5 (2.5)	23 (11.4)	173 (86.1)		4.18 (0.79)
Diversity of drug forms	9 (4.5)	54 (26.9)	138 (68.7)		3.80 (0.77)
Professional principle				3.97 (0.48)	
Local treatment guidelines	2 (1.0)	21 (10.4)	178 (88.6)		4.07 (0.60)
National treatment guidelines	3 (1.5)	37 (18.4)	161 (80.1)		4.00 (0.70)
Availability of drugs covered by health insurance	11 (5.5)	33 (16.4)	157 (78.1)		3.85 (0.78)
Pharmacist factors				3.89 (0.62)	
Pharmacist-medical staff collaboration in managing drug therapy of patients	11 (5.5)	21 (10.4)	169 (84.1)		4.08 (0.80)
Recommendation of pharmacists regarding prescribing certain medications from some companies before prescribing	6 (3.0)	52 (25.9)	143 (71.1)		3.84 (0.73)
Pharmacists are a reliable source of general drug information	10 (5.0)	55 (27.4)	136 (67.7)		3.76 (0.80)
Information available on a drug				3.86 (0.57)	
Scientific evidence from clinical studies about the medicine	7 (3.5)	16 (8.0)	178 (88.6)		4.24 (0.74)
Drug information published in medical journals	9 (4.5)	29 (14.4)	163 (81.1)		4.01 (0.77)
Drug information available on the Internet	28 (13.9)	89 (44.3)	84 (41.8)		3.32 (0.86)
Brand of a drug				3.67 (0.47)	
Drugs have a good reputation and reliable brand	4 (2.0)	24 (11.9)	173 (86.1)		4.09 (0.67)
Confidence in drug manufacturer	8 (4.0)	52 (25.9)	141 (70.1)		3.75 (0.66)
Drugs that have a brand already been tested by colleagues	33 (16.4)	103 (51.2)	65 (32.3)		3.18 (0.80)
Medical staff habit persistence				3.61 (0.57)	
Positive clinical experiences of other medical staff with a brand lead to brand loyalty	1 (0.5)	24 (11.9)	176 (87.6)		4.18 (0.65)
Prescribing the same drug that I have had a positive experience with	13 (6.5)	51 (25.4)	137 (68.2)		3.66 (0.77)
Prescribing the same drug that I have had a positive experience with the patient	59 (29.4)	74 (36.8)	68 (33.8)		3.00 (1.02)
Patient characteristics				3.40 (0.64)	
Patients' current disease status	4 (2.0)	14 (7.0)	183 (91.0)		4.23 (0.66)
Patient expectations	40 (19.9)	61 (30.3)	100 (49.8)		3.33 (0.94)
Patient request for drug	98 (48.8)	48 (23.9)	55 (27.4)		2.66 (1.14)
Sales promotion				3.04 (0.77)	
Effectiveness of medical representatives	28 (13.9)	96 (47.8)	77 (38.3)		3.27 (0.83)
The free samples of the medicine	42 (20.9)	103 (51.2)	56 (27.9)		3.10 (0.92)
Getting a commission from a drug company when prescribing	86 (42.8)	66 (32.8)	49 (24.4)		2.74 (1.04)

[a]Disagree: combined responses of strongly disagree and disagree; [b]Agree: combined responses of strongly agree and agree.

Furthermore, less than half of the participants in this study agreed that the 'patient characteristics' factor, such as patient request (27.4%) and expectations for drug (49.8%), had an influence on prescribing behavior. These results are consistent with studies by Kamuhabwa and Kisoma,[50] and Theodorou *et al.*[24] Nevertheless, in this domain, patients' current disease status was considered to have an impact on a majority of participants (91.0%). Tan *et al.*[26] reported a similar result with our findings. Patients' current disease status has an integral role because medical staff consider patients to be at the center of the prescription decision-making process; and improvement of patients' treatment outcomes as a goal to be achieved. Our study also found that younger prescribers are more affected by this factor than older ones.

Among Asian countries, Vietnam has a rapidly growing domestic pharmaceutical market in recent years.[4] As a result, there is a rapid increase in the number of domestic and foreign invested pharmaceutical companies, leading to increased competition between them. Consequently, the need of sales promotion and marketing activities increased dramatically. In fact, the effectiveness of marketing strategy was proven in different studies of Shimura *et al.*,[64] Vancelik *et al.*,[65] Ahmed *et al.*[66] and Kisa.[48] However, based on data from this study, a very small number of participants (<40%) agreed with the effectiveness of the sales promotion activities of pharmaceutical companies on their prescribing decisions in the Mekong Delta. The finding is similar to the study by Schumock *et al.*,[9] Sharifnia *et al.*,[25] Avorn *et al.*,[61] Lieb Brandtönies,[67] Ferdoush *et al.*[49] and Al-Areef *et al.*[8] Our data showed that prescribers with lower incomes (<VND 4.2 million) were more influenced by sales promotion than other income groups. Additionally, a majority of prescribers (>70%) agreed that factor 'brand of a drug' such as a good reputation and

Table 5 Differences in influences on prescribing decision among groups of medical staff's demographics characteristics

Demographics (N = 201)	Number of respondents	Mean (SD)								
		Cost/benefit ratio of a drug	Drug characteristics	Professional principle	Pharmacist factors	Information available on a drug	Brand of a drug	Medical staff habit persistence	Patient characteristics	Sales promotion
Gender[a]										
Male	130	4.17 (0.50)	4.12 (0.48)	4.00 (0.50)	3.92 (0.64)	3.89 (0.58)	3.64 (0.45)	3.62 (0.56)	3.37 (0.62)	3.04 (0.80)
Female	71	4.18 (0.58)	4.15 (0.56)	3.92 (0.46)	3.85 (0.57)	3.80 (0.54)	3.73 (0.51)	3.61 (0.60)	3.47 (0.67)	3.04 (0.70)
T-value		0.022	0.161	1.329	0.519	1.208	1.466	0.021	1.127	0.003
P-value		0.881	0.689	0.250	0.472	0.273	0.227	0.884	0.290	0.955
Age (years)[b]										
21–30	100	4.24 (0.56)	4.17 (0.53)	4.01 (0.51)	4.00 (3.67–4.33)	3.84 (0.58)	3.7 (0.510)	3.57 (0.59)	3.52 (0.63)	3.15 (0.79)
31–40	64	4.11 (0.49)	4.05 (0.49)	3.96 (0.46)	4.00 (3.67–4.00)	3.85 (0.60)	3.66 (0.42)	3.67 (0.53)	3.38 (0.56)	2.98 (0.74)
40+	37	4.09 (0.50)	4.13 (0.47)	3.91 (0.46)	3.67 (3.33–4.33)	3.92 (0.49)	3.64 (0.47)	3.65 (0.58)	3.14 (0.72)	2.82 (0.70)
F-value		1.575	1.111	0.582	9.822	0.285	0.257	0.682	5.154	2.831
P-value		0.210	0.331	0.560	**0.007**[c]	0.752	0.774	0.507	**0.007**	0.061
Education[a]										
Physician assistant	145	4.15 (0.55)	4.11 (0.53)	3.97 (0.50)	3.86 (0.63)	3.85 (0.57)	3.67 (0.49)	3.60 (0.59)	3.42 (0.64)	3.07 (0.77)
Physician	56	4.23 (0.46)	4.17 (0.44)	3.97 (0.44)	3.96 (0.59)	3.88 (0.56)	3.68 (0.42)	3.64 (0.53)	3.36 (0.65)	2.96 (0.76)
T-value		0.849	0.651	0.003	1.062	0.134	0.044	0.203	0.426	0.718
P-value		0.358	0.421	0.953	0.304	0.714	0.834	0.653	0.515	0.398
Experience (years)[b]										
1–5	66	4.27 (0.53)	4.20 (0.47)	4.06 (0.49)	3.97 (0.59)	3.92 (0.58)	3.79 (0.46)	3.58 (0.59)	3.51 (0.53)	3.12 (0.73)
6–10	84	4.12 (0.55)	4.09 (0.56)	3.96 (0.49)	3.89 (0.62)	3.81 (0.58)	3.60 (0.50)	3.65 (0.59)	3.42 (0.65)	3.08 (0.80)
10+	51	4.13 (0.49)	4.09 (0.47)	3.88 (0.46)	3.79 (0.65)	3.86 (0.52)	3.64 (0.41)	3.61 (0.53)	3.25 (0.73)	2.86 (0.74)
F-value		1.851	1.100	2.142	1.286	0.694	3.065	0.288	2.390	1.984
P-value		0.160	0.335	0.120	0.279	0.501	**0.049**	0.750	0.094	0.140
Income (VND million/month)[b]										
<4.2	104	4.21 (0.53)	4.14 (0.46)	3.99 (0.51)	4.01 (0.55)	3.84 (0.55)	3.71 (0.45)	3.62 (0.52)	3.49 (0.58)	3.18 (0.77)
4.3–8.3	43	4.26 (0.42)	4.21 (0.52)	4.00 (0.40)	3.83 (0.57)	3.87 (0.60)	3.71 (0.49)	3.64 (0.67)	3.30 (0.66)	2.86 (0.75)
≥8.4	34	4.05 (0.52)	4.12 (0.46)	3.93 (0.50)	3.58 (0.75)	3.92 (0.56)	3.55 (0.48)	3.65 (0.50)	3.12 (0.70)	2.71 (0.66)
F-value		1.984	0.446	0.243	6.839	0.274	1.684	0.030	5.080	6.496
P-value		0.166	0.641	0.784	**0.001**	0.761	0.189	0.971	**0.007**	**0.002**

[a]By *t*-test, Mean (SD); [b]by one-way ANOVA, Mean (SD); [c]by Kruskal–Wallis test, Chi-square value, Median (IQR); Bold numbers: significant at $P < 0.05$.

Table 6 Association between medical staff's demographics and factors influencing prescribing decision using post hoc tests

Demographics	Pharmacist factors		Brand of a drug		Patient characteristics		Sales promotion	
	Mean (SD) or Median (IQR)	*P*-value	Mean (SD)	*P*-value[b]	Mean (SD)	*P*-value[b]	Mean (SD)	*P*-value[b]
Age, years								
21–30 versus 31–40	4.00 (3.67–4.33) versus 4.00 (3.67–4.00)	**0.010**[a]	–	–	3.52 (0.63) versus 3.38 (0.56)	0.347	–	–
21–30 versus 40+	4.00 (3.67–4.33) versus 3.67 (3.33–4.33)	**0.013**[a]	–	–	3.52 (0.63) versus 3.14 (0.72)	**0.005**	–	–
31–40 versus 40+	4.00 (3.67–4.00) versus 3.67 (3.33–4.33)	0.594[a]	–	–	3.38 (0.56) versus 3.14 (0.72)	0.144	–	–
Experience, years								
1–5 versus 6–10	–	–	3.79 (0.46) versus 3.60 (0.50)	**0.045**	–	–	–	–
1–5 versus 10+	–	–	3.79 (0.46) versus 3.64 (0.41)	0.210	–	–	–	–
6–10 versus 10+	–	–	3.60 (0.50) versus 3.64 (0.41)	0.894	–	–	–	–
Income (VND million/month)								
<4.2 versus 4.3–8.3	4.01 (0.55) versus 3.83 (0.57)	0.233[b]	–	–	3.49 (0.58) versus 3.30 (0.66)	0.210	3.18 (0.77) versus 2.86 (0.75)	**0.047**
<4.2 versus ≥8.4	4.01 (0.55) versus 3.58 (0.75)	**0.001**[b]	–	–	3.49 (0.58) versus 3.12 (0.70)	**0.007**	3.18 (0.77) versus 2.71 (0.66)	**0.004**
4.3–8.3 versus ≥8.4	3.83 (0.57) versus 3.58 (0.75)	0.161[b]	–	–	3.30 (0.66) versus 3.12 (0.70)	0.401	2.86 (0.75) versus 2.71 (0.66)	0.638

[a]By post-hoc Mann–Whitney test for Kruskal–Wallis test, Median (IQR); [b]by post hoc Tukey for ANOVA, Mean (SD); Bold numbers: significant at $P < 0.05$.

reliable brand of drug (86.1%) and confidence in drug manufacturer (70.1%) had influences on their choice of medication. Prescribers with 6–10 years of experience were less affected by this factor than prescribers with less experience. These results could help drug companies in building appropriate marketing strategies for Vietnamese pharmaceutical market.

The overall results of this study provide essential data for policy makers, educators and pharmaceutical companies to identify priority investments affecting the medical staff's prescription decision. For example, pharmaceutical marketers should develop strategies to promote the company's brands instead of focusing on marketing activities (i.e. via medical representatives and gimmicks). The focus on prescribers with little experience and low income may bring high efficiency for these activities. Providing products at competitive prices, evidence of drug effectiveness and safety can be a strength of pharmaceutical companies in competition. Previous studies indicated that pharmaceutical promotions were associated with increased prescription rates and less rational prescribing.[68–70] Therefore, ethical criteria for promotional activities in Vietnam must be established by pharmaceutical companies and regulators through presenting drugs objectively and without overstating their properties. In addition, regulators in Vietnam need a mechanism to monitor promotional campaigns to ensure the balance between effects of pharmaceutical marketing and better rational prescribing. On the other hand, policy-makers might establish schemes that enhance the role of pharmacists in a cooperative relationship with prescribers in hospital. In Vietnam, clinical pharmacy activities, including providing information, advising on medicines for medical staff, and helping optimize treatment regimens, have been guided by the Ministry of Health in Circular No. 31/2012/TT-BYT. However, in reality, the role of clinical pharmacy and its funding have not been adequately supported. Thus, regulators need timely improvement and intervention to take full advantage of the pharmacist's ability to support medical staff prescriptions. Because some pharmacist interventions were proven to improve the effectiveness of medical staff prescribing and patient outcomes.[35, 36] Additionally, policy-makers also need to develop solutions and policies to increase the medical workers income, as >50% of the surveyed prescribers had lower income than per capita monthly income of the country (VND 4.2 million, according to statistics in 2019).[71] Last but not least, educators need to develop continuous training programs to update professional knowledge for clinical pharmacists, and create hospital-school coordination in clinical pharmacy training. Increasing knowledge of prescription can be accomplished through educating prescribers in using evidence-based medicine and trusted drug information sources from clinical studies, medical scientific journals, treatment guidelines and pharmacists.

Limitations

Although finding new and interesting knowledge on the factors affecting prescribing patterns of Mekong Delta medical staff, our research had some limitations. First, it is uncertain whether the study sample is representative of the population of medical staff in Mekong delta due to the conveniently participants recruitment. Distribution of participants between provinces/cities in the Mekong Delta was uneven in the collected sample. There were only few participants from the provinces of Ben Tre (3.0%) and Tra Vinh (3.5%). In addition, a large proportion of participants in the study were physician assistants (72%). This figure did not reflect the actual human resources of the Mekong Delta, where the ratio of physician and physician assistant

was approximately 1:1 according to the General Statistics Office of Vietnam in 2017.[38] Therefore, future research should have a more appropriate sampling strategy to obtain the representative population of Mekong Delta's medical staff. Second, variables of work and practice settings (primary care, secondary care, and others) are not included in the questionnaire. For further research, these variables should be added to explore if there are differences in factors influencing prescribing decisions based on the practice settings. Third, the current study has attempted to include as many of the important factors as possible, however, the omission of a few factors that may bring meaningful in the context in Vietnam cannot be prevented. This was due to the lack of related literature in Vietnam on the research topic, and the increased burden on respondents in case large number of questions were used. Future research should incorporate new factors from latest literature and increase the number of factors. Moreover, qualitative studies should be considered to identify factors that may contribute to prescribing the drug in Vietnam. Fourth, as the result of assessing the psychometric properties of the instrument, two items (Scientific evidence from clinical studies about the medicine; Drug safety and efficacy) with low PTMEA corr values may be considered suitable for the measurement purpose of this study because their values were positive numbers and close to 0.3. Domain 'cost/benefit ratio of a drug' had a low separation index (1.6). Although its value was within the acceptance limit of 1.5,[45] improvement of the questionnaire in the future research should be considered with the goal of further increasing the quality of the study instrument by modifying and increasing the number of items for this domain.

Conclusion

This study identified different factors which are significant determinants of decision making of the Mekong Delta's medical staff. 'Cost and benefit ratio' factor category including history interferes (92.0%), the income of the patient (92.0%), and drug price (84.1%) the most frequently mentioned by medical staff as reasons of prescribe, followed by 'drug characteristics' related factors, such as drug efficacy, safety (92.5%) and side effects (86.1%). Only a small number of medical staff (<40%) agreed with the effectiveness of the sales promotion activities of pharmaceutical companies on their prescribing decisions in the Mekong Delta, such as medical representatives (38.3%), free samples (27.9%), and commission (24.4%). The high attention of medical staff to the medicine cost could bring potential economic benefits to the people of the Mekong Delta, but their expectations and requirements are often unsatisfied. Furthermore, data against the effectiveness of sales promotion activities in Vietnamese pharmaceutical companies were found and discussed. Nevertheless, the multi-factor needs to be studied further to determine exactly the effectiveness of pharmaceutical marketing strategies. This research could be useful for pharmaceutical companies in marketing strategy planning and policy makers in health orientation.

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Author contributions

V.D.T.: conceptualization, methodology, validation, formal analysis, investigation, resource, writing-review and editing, project administration; investigation, supervision; N.T.T.C., M.H.L., D.T.P. and K.T.N.: methodology, formal analysis, writing-original draft, writing-review and editing; V.V.D. and E.E.L.: review and editing.

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Conflict of Interest

None.

Data availability

The data that support the findings of this study are available from the corresponding author Duy Toan Pham (i.e. upon reasonable request).

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