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ORIGINAL RESEARCH

Influencing Factors of Generic Prescribing Behavior of Physicians: A Structural Equation Model Based on the Theory of Planned Behavior

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Background: Although affordable generics could probably contribute to the solution of rapidly increasing pharmaceutical expenditure, those drugs are prescribed at a lower rate in China. Physicians' perception and knowledge of generics have a great influence on their prescribing behavior.

Objective: This study aimed to identify factors that affect physicians' generic prescribing behavior based on the theory of planned behaviors (TPB).

Methods: Data were collected by both electronic and paper-based surveys from 1297 Chinese physicians, and 1047 surveys were retained. The structural equation model (SEM) was employed to investigate the relationship between four behavioral constructs, namely, attitudes, subjective norms, perceived control of behaviors, and intentions.

Results: About 50% of Chinese physicians had a positive attitude towards generic drugs that had passed the "Consistency Evaluation of Quality and Efficacy of Generic Drugs" (high-quality generic drugs), but their knowledge of generic drugs was relatively inadequate. The path coefficients for the effect of attitudes, subjective norms, and perceived behavioral control on behavioral intention were 0.285, 0.366, and 0.322 respectively. The path coefficients for the effect of behavioral intention and perceived behavioral control on prescribing behavior were 0.009 and 0.410 respectively.

Conclusion: Physicians' attitudes, subjective norms, and perceived behavioral control were significant positive correlation predictors of behavioral intention. Subjective norms and perceived behavior control had a greater impact than attitude on physicians' prescribing intention. However, the generic prescribing behavior is not under the volitional control of Chinese physicians. Physicians' prescribing practice is likely affected by perceived strong control over prescribing generic drugs.

Keywords: generic prescribing behavior, perception, structural equation model, theory of planned behaviors

Introduction

The rapidly increasing pharmaceutical expenditure has become a global public health issue that imposes significant financial burdens on patients worldwide.[1,2] These increases have been partially attributed to the high cost of originator drugs.[3,4] Consequently, many countries have formulated policies to promote the substitution of these expensive originator drugs with more affordable generic alternatives.[5,6]

The Chinese government has also implemented a series of health policies to encourage the development of generics to promote market competition and to reduce drug costs. Nevertheless, generics are prescribed at a lower rate in China.[7–10] In March 2016, China launched the "Consistency Evaluation of Quality and Efficacy of Generic Drugs" procedure to improve the quality of marketed generic drugs. Under this procedure, manufacturers are required to conduct

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pharmacological tests, bioequivalent tests (originators as reference drugs), and clinical efficacy studies (if necessary). Despite substantial evidence about the therapeutic equivalence between originator drugs and generics today, the usage of the latter failed to improve generic substitution as expected.

In 2020, generic drugs accounted for only 53.3% of the pharmaceutical market share.[11] Pharmacists in China do not have the authority to modify medication orders written by physicians (eg substituting the originator prescribed by physicians with the generic counterpart), which underscored the important role of physicians as the gatekeepers who can decide whether to prescribe originators or generics.[12,13] Therefore, the perception of physicians on generics might be a critical factor that affects the degree to which generics are prescribed.

Fishbein and Ajzen proposed the Theory of Reasoned Action (TRA) as a social-cognitive model aimed at evaluating psychographic factors related to human behavior. TRA posits that individuals' behaviors are rational and goal-directed, thus focusing on identifying the determinants shaping behavior within social contexts.[14] Ajzen expanded on this foundation in the subsequent Theory of Planned Behavior (TPB), by including perceived behavioral control as another variable in the TRA model. Despite some criticism and several competing behavioral models, TPB, which is still regarded as the most popular social-psychological theory and the most effective model for explaining individuals' behaviors in numerous fields,[15] has received considerable empirical support across health behaviors.[16–18]

To our knowledge, there is no empirical TPB study on physicians' generic drug prescribing behavior in China. Although similar studies have been conducted in other countries, the applicability of these findings is limited due to different healthcare systems, insurance structures and generic industry practices. Thus, the objective of this study was: (1) to assess the effectiveness of the TPB model in elucidating physicians' generic prescribing behavior, and (2) to identify the factors influencing their behavior.

Method

Scientific Theory and Model Hypotheses

The TPB proposes that individual behavior is boosted by strong intention and perceived behavior control, and it postulates that behavioral intention (BI) is shaped by the attitude towards that behavior (ATT), subjective norms (SN), and perceived behavioral control (PBC) regarding that behavior. The behavior investigated in this study was generic prescribing behavior (PB). For simplification, the generic drugs that have undergone the necessary evaluation outlined in the "Consistency Evaluation of Quality and Efficacy of Generic Drugs" would be termed as **"high-quality generic drugs"** in the following text. This simplification was only used in the drafting of this article, not in the survey process.

BI indicates individuals' intention in terms of their conscious decision or plan to exert effort towards engaging in certain behaviors,[14] which can be interpreted as "the extent to which a person intends to perform specific behaviors, whether positive or negative". This study assumed that physicians with strong intentions were more likely to prescribe high-quality generic drugs in their clinical practice.

Ajzen defines ATT as "the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question". Attitude towards certain behavior depends on one's overall evaluation of certain behavior and belief in its desirable outcomes.[19] The theory predicts that an individual's more positive attitude towards certain behavior can lead to a stronger intention to perform that behavior.[15] In this context, this study posits that physicians would be inclined to prescribe high-quality generic drugs if they believed that there was no significant difference between these generics and originator drugs in terms of safety,[20] efficacy,[20–23] and quality.[21,24]

Ajzen defines SN as "the perceived social pressure to perform or not to perform certain behavior". An individual's behavioral intention is usually influenced by the expectations of a group or society to which he/she belongs. These expectations could be classified into injunctive norms (perceptions of what others recognize as correct behavior) and descriptive norms (perceptions of what others actually did). Herein, this study referred to subjective norms as "the extent to which physicians are influenced by different sources of external pressure to prescribe high-quality generic drugs in their daily work". For example, the external pressure from patients, colleagues, superior physicians, and even medical sales representatives (MSR) can influence physicians' prescribing behavior,[25–27] and may vary across different medical

institutions. This study assumed that physicians who perceive subjective norms encouraging them to prescribe high-quality generic drugs from others involved in the prescribing process are more likely to have a stronger intention to do so.

Ajzen defines PBC as "the perceived ease or difficulty of performing the behavior". This study interpreted PBC as "the perceived power and knowledge of physicians to prescribe high-quality generic drugs". This study assumed that physicians are more likely to form an intention to prescribe those drugs when they believe that they possess adequate knowledge, skills, and resources.[12] In addition, the availability of drugs in stock could also affect physicians' choices.[28]

This study presented the following hypotheses and constructed the research model shown in Figure 1. They are based on the assumption that a more positive ATT, stronger SN, and better PBC will boost an individual's intention of performing a given behavior.

Study Sample and Data Collection

This study developed a survey tool enriched by reference to previous studies on physicians' prescribing behavior of generic drugs in other countries. The survey toll was critiqued by experts who recommended further amendments. A pilot test of the survey was conducted in 2019 followed by the formal survey in 2020. The survey development process included the design of survey-based literature and stakeholder interviews. The initial survey was piloted with a cohort of 116 physicians to ensure feasibility and to optimize the sequence of questions. The results obtained from the pilot study were not included in the final analysis.

After making minor modifications to the statements in the text of the questionnaire (Supplementary Table A), the final version of the survey was estimated to take 10–15 minutes to complete. The structural equation model (SEM) was employed to investigate the relationship between four behavioral constructs, namely, attitudes, subjective norms, perceived control of behaviors, and intentions. It consisted of 35 questions, which were divided into seven domains: (1) physicians' general characteristics (6 items), (2) physicians' knowledge of generic drug policies (6 items), (3) physicians' attitude towards high-quality generic drugs (6 items), (4) physicians' subjective norm on prescribing high-quality generic drugs (5 items), (5) physicians' perceived behavioral control (6 items), (6) physicians' behavioral intention to prescribe high-quality generic drugs (4 items), (7) physicians' prescribing behavior in the past (2 items). A 5-point Likert Scale was used to measure each item included in (3) - (7). For (3) - (6), we assigned the values of 1, 2, 3, 4, and 5 to "strongly disagree", "disagree", "hard to explain", "agree", and "strongly agree", respectively. For (7), we assigned the values of 1, 2, 3, 4, and 5 to "never", "<10%", "10–30%", "30–60%", and ">60%", respectively. Paper-based or electronic versions (created on the survey platform, 'Wenjuanxing'[29] were disseminated according to the preference of the participants. If physicians volunteered to participate in this study, they were requested to answer all questions. Incomplete surveys were excluded from the statistical analysis. We calculated the minimum required sample size for our survey based on findings from previous studies.[30–33]

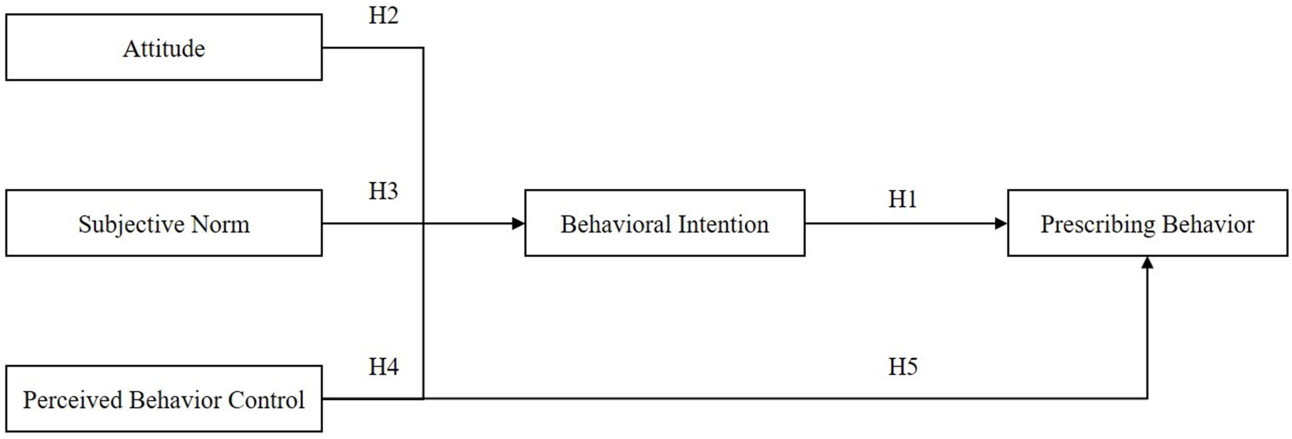

Figure 1 Structural Equation Model.

Notes: **H1**: Physicians' intention to prescribe high-quality generic drugs boosts their clinical practice behavior. **H2**: Physicians' positive attitude towards high-quality generic drugs strengthens their intention to prescribe them. **H3**: Physicians' perceived subjective norms of prescribing high-quality generic drugs strengthen their intention to prescribe those drugs. **H4**: Physicians' perceived behavioral control regarding prescribing high-quality generic drugs strengthens their intention to prescribe those drugs. **H5**: Physicians' perceived behavioral control regarding prescribing high-quality generic drugs boosts their clinical practice behavior.

Researchers randomly selected hospitals from different regions of China and provided training to the staff members from the scientific research department of those hospitals. These staff members were compensated for their services, which only involved randomly selecting physicians using a convenience sampling method, distributing questionnaires to selected physicians, and collecting the completed questionnaires. Subsequently, offline questionnaires were double-entered by trained members of the research team, and the data was reviewed by a third member to ensure accuracy and authenticity.

All formal surveys were administered electronically. The questionnaires were completed using a convenience sampling method, with participating physicians assigned by research administrators within the sample hospitals. In total, 1297 physicians participated in the study. However, 35 surveys were unfilled (no data), and 215 surveys were considered invalid due to repeated entries or an answering time of less than 3 minutes (the data were likely randomly generated and had no value). After addressing missing data using listwise deletion, 1047 physicians were ultimately included in this study. The respondents were from 121 hospitals located in 14 provinces from the eastern, central, and western regions of China. These provinces included but were not limited to Jiangsu, Beijing, Guangdong, and Xinjiang. The study protocol was approved by the Peking University Medical Ethics Committee (IRB00001052–19,026). All participants provided written informed consent and we did not collect the names of physicians or hospitals.

Data Analysis

The responses from physicians were described using descriptive statistics based on frequency and percentage. Structural Equation Modeling (SEM) was employed to simultaneously model several explanatory variables and multiple outcomes. Observed variables were utilized to estimate latent variables. Content validity was analyzed using Bartlett's test. The validity of the construct (measurement model) was analyzed using the Kaiser-Meyer-Olkin measure of sampling adequacy and was evaluated empirically through confirmatory factor analysis (CFA). CFA is defined as the extent to which the measured items reflect the constructs that they are designed to measure. Both convergent and discriminant validity were evaluated to examine the construct validity. For convergent validity, defined as the level of coherence across the items within each construct, three indicators were assessed:[34] standardized factor loadings (each of them $\geq$ 0.5), average variance extracted (AVE $\geq$ 0.5), and composite reliability (CR $\geq$ 0.7)[35] Discriminant validity was defined as the degree to which items differentiate between constructs, and was examined according to the approach proposed by Hair et al.[35] Each AVE in a measurement model should have higher than the average shared squared variance (ASV), and the maximum shared squared variance (MSV) among all constructs.

Structure model fit[36] was confirmed using normed Chi-square (χ^2/df < 3.0), goodness-of-fit index (GFI > 0.90), adjusted goodness-of-fit index (AGFI > 0.90), comparative fit index (CFI > 0.90), incremental fit index (IFI > 0.90), and root mean square error of approximation (RMSEA < 0.05).

This study used the maximum likelihood (ML) method to analyze the model. Path analysis was performed to examine relationships among the variables within the established SEM. The standardized path coefficient values (range from −1 to +1) were considered as the main outcomes. The ML method requires that model data must follow a multivariate normal distribution, otherwise biased estimators would result. However, we acknowledged that ML estimators are still known to be robust (except for inflated model fit values, eg Chi-square value) with relatively large data following slightly non-normal distribution (Skew < 2 and Kurtosis < 7).[37] This study confirmed the robustness and significance of results by bootstrapping if data did not follow a multivariate normal distribution (multivariate Kurtosis CR > 5). After that, this study would correct all model fit indices according to the Bollen-Stine bootstrapping method.[38,39]

Data were analyzed using SPSS version 24.0 for Windows and AMOS version 24.0. For all statistical analyses, a p-value <0.05 was considered statistically significant at a 95% confidence level.

Results

Physicians' General Characteristics

In total, 1297 physicians participated in the study. Of these, 35 surveys were incomplete and were excluded from the final analysis. Another 215 surveys were excluded due to response times falling below the minimum required threshold,

indicating potential low-quality responses. As a result, data analyses were conducted on responses from 1047 (80.7%) participants from 101 hospitals.

Table 1 shows the general characteristics of the 1047 physicians participating in this study. The majority of these physicians held master's degrees (452; 43.2%), and were employed at tertiary hospitals (794; 75.8%). Only 11.4% of the physicians had more than 20 years of work experience.

Physicians' knowledge of high-quality generic drugs and related policies.

Less than a quarter (24%) of physicians explicitly stated that they knew about high-quality generic drugs and could recognize the "high-quality" mark on drug packages. Only 26.1% of physicians accurately answered questions about

Table 1 Physicians Characteristics

Characteristics		Frequency	Percentage
Sex	Female	521	49.80%
	Male	526	50.20%
Years of clinical practice of physicians	≤10	692	66.10%
	(10, 20]	236	22.50%
	>20	119	11.40%
Highest educational attainment of physicians	Undergraduate and below	355	33.90%
	Master	452	43.20%
	PhD	240	22.90%
Hospital level	Tertiary	794	75.80%
	Secondary	233	22.30%
	Primary	20	1.90%
Hospital Location	Jiangsu	565	54.00%
	Beijing	294	28.10%
	Guangdong	76	7.30%
	Xinjiang	73	7.00%
	Fujian	39	3.70%
Specialty	Cardiology	92	8.79%
	Infectious diseases	20	1.91%
	Endocrinology	41	3.92%
	Respiration	53	5.06%
	Gastroenterology	37	3.53%
	Nephropathy	22	2.10%
	Oncology	45	4.30%
	Hematology	31	2.96%
	Neurology	59	5.64%
	Internal medicine	24	2.29%
	Thoracic surgery	23	2.20%
	Urology	27	2.58%
	Neurosurgery	29	2.77%
	Orthopedics	66	6.30%
	General surgery	53	5.06%
	Gynecology	43	4.11%
	Obstetrics	27	2.58%
	Pediatrics	58	5.54%
	Dermatology	23	2.20%
	Emergency	32	3.06%
	Psychiatry	13	1.24%
	Others	229	21.87%

bioequivalence trials, and 33.4% of physicians correctly answered the definition of narrow therapeutic index drugs. Approximately half (50.9%) of physicians correctly answered the question about the National Volume-based Procurement policy (Table 2).

Physicians' Psychological Measurements of High-Quality Generic Drugs

Approximately 50% of physicians recognized that the safety, quality, and efficacy of high-quality generic drugs were comparable with originator drugs; 57.6% of physicians preferred to prescribe high-quality generic drugs rather than originator drugs; about two-thirds (64.3%) recommended establishing a positive list of generic drugs that includes high-quality generic drugs proven to be interchangeable with originator drugs in clinical practice.

Hospitals were reported to have measures to encourage the use of generic drugs by 57.0% of physicians; nearly two-thirds (62.9%) reported that their patients agreed to accept generic prescriptions, and 52.5% mentioned that their supervisors encouraged them to prescribe high-quality generic drugs.

Hospitals were reported to have a sufficient stock of high-quality generic drugs by 53.7% of physicians; 43.5% of physicians explicitly reported that they were familiar with the list of high-quality generic drugs developed through the Consistency Evaluation; 53.1% of physicians had confidence in judging whether high-quality generic drugs should be prescribed after identifying patients' specific conditions.

Most (71.0%) physicians indicated their willingness to prescribe high-quality generic drugs in the future, and about half (52.2%) were willing to prioritize these generic drugs.

Physicians' Actual Prescribing Behaviors

When hospitals were equipped with both originator drugs and the evaluated generic counterparts, 714 (68.2%) physicians had a relatively low prescribing rate (<30%) of those generics, and 246 (23.5%) physicians had never prescribed high-quality generic drugs (Table 3).

Structural Equation Model

Even no multicollinearity existed among the observational variables, survey data did not follow a multivariate normal distribution (Skew < 2 and Kurtosis < 7). This survey tool demonstrated adequate construct and content validity, as indicated by a Kaiser-Meyer-Olkin measure of 0.95 and a Bartlett's squareness test p-value < 0.001.

A summary of the findings from the CFA is displayed in Table S1. The observational variables seemed to reflect these latent variables well because all standardized factor loadings were significant ($p < 0.001$), and standardized factor loadings for the items were between 0.674 and 0.959, which exceeded the critical value of 0.60. All CR values were above 0.89 (acceptable minimum value = 0.7), and all AVE values for latent variables were greater than 0.63 (acceptable minimum value = 0.5). Discriminant validity exists if the square root of the AVEs for each latent variable exceeds the

Table 2 Physicians' Knowledge of Generic Drug Policies

Item	Implication of item	N (%)				
		Strongly disagree	Disagree	Hard to explain	Agree	Strongly agree
Cog 1	I am able to recognize the mark "Passed the Consistency Evaluation of Quality and Efficacy of Generic Drugs" on the packaging of drugs	146(13.9)	342(32.7)	335(32.0)	170 (16.2)	54(5.2)
Cog 2	I am familiar with the content of the Consistency Evaluation of Quality and Efficacy of Generic Drugs	99(9.5)	330(31.5)	373(35.6)	198 (18.9)	47(4.5)
Cog 3	I am aware that China had generic drug evaluation policies in place from 2012 to 2014	119(11.4)	358(34.2)	349(33.3)	183 (17.5)	38(3.6)
		Wrong answer		Not sure	Correct answer	
Cog 4	Question about geometric mean ratio in bioequivalence studies	166(15.8)		608(58.1)	273(26.1)	
Cog 5	Question about the National Volume-based Procurement policy	226(21.6)		288(27.5)	533(50.9)	
Cog 6	Question about narrow therapeutic index drugs	359(34.3)		338(32.3)	350(33.4)	

Table 3 Physicians' Psychological Measurements of High-Quality Generic Drugs

Item	Implication of item	N (%)				
		Strongly disagree	Disagree	Hard to explain	Agree	Strongly agree
ATT1	There is no difference in safety between high-quality generic drugs and originator drugs	36(3.4)	117(11.2)	307(29.3)	455(43.5)	132(12.6)
ATT2	There is no difference in clinical efficacy between high-quality generic drugs and originator drugs	35(3.3)	142(13.6)	344(32.9)	407(38.9)	119(11.4)
ATT3	There is no difference in quality between high-quality generic drugs and originator drugs	35(3.3)	157(15.0)	377(36.0)	369(35.2)	109(10.4)
ATT4	High-quality generic drugs can be substituted for originator drugs in clinical practice	36(3.4)	159(15.2)	335(32.0)	408(39.0)	109(10.4)
ATT5	We need to establish a positive list of high-quality generic drugs that have been demonstrated to be interchangeable with originator drugs	23(2.2)	121(11.6)	230(22.0)	538(51.4)	135(12.9)
ATT6	I prefer to prescribe high-quality generic drugs over originator drugs	27(2.6)	148(14.1)	269(25.7)	468(44.7)	135(12.9)
SN1	My patients are willing to accept my prescription of high-quality generic drugs	21(2.0)	64(6.1)	303(28.9)	503(48.0)	156(14.9)
SN2	My colleagues prescribe high-quality generic drugs more frequently than originator drugs	21(2.0)	109(10.4)	430(41.1)	388(37.1)	99(9.5)
SN3	My supervisors encourage me to prescribe high-quality generic drugs instead of originator drugs	17(1.6)	125(11.9)	356(34.0)	435(41.6)	114(10.9)
SN4	Pharmaceutical representatives from manufacturers of high-quality generic drugs provided me with more information about their products	41(3.9)	161(15.4)	365(34.9)	380(36.3)	100(9.5)
SN5	This hospital has implemented measures to promote the utilization of high-quality generic drugs	20(1.9)	106(10.1)	325(31.0)	457(43.7)	139(13.3)
PBC1	I am familiar with the list of high-quality generic drugs	30(2.9)	165(15.8)	428(40.9)	326(31.1)	98(9.4)
PBC2	My professional skills and clinical experience allow me to determine whether high-quality generic drugs are appropriate for my patients after conducting a thorough check-up	21(2.0)	137(13.1)	333(31.8)	453(43.3)	103(9.8)
PBC3	I have a thorough understanding of the efficacy and potential adverse reactions of high-quality generic drugs	23(2.2)	144(13.8)	365(34.9)	415(39.6)	100(9.5)
PBC4	High-quality generic drugs are well-stocked in this hospital	23(2.2)	99(9.5)	363(34.7)	433(41.4)	129(12.3)
PBC5	The drug lists proposed by the National Volume-based Procurement policy are familiar to me	35(3.3)	149(14.2)	407(38.9)	353(33.7)	103(9.8)
PBC6	I am capable of convincing my patients to use high-quality generic drugs	26(2.5)	126(12.0)	401(38.3)	396(37.8)	98(9.4)
BI1	I plan to prescribe high-quality generic drugs in the future	10(1.0)	48(4.6)	245(23.4)	615(58.7)	129(12.3)
BI2	I am convinced that high-quality generic drugs provide advantages over originator drugs	36(3.4)	133(12.7)	405(38.7)	373(35.6)	100(9.6)
BI3	I will suggest high-quality generic drugs to both my patients and colleagues	22(2.1)	72(6.9)	365(34.9)	484(46.2)	104(9.9)
BI4	In general, I prefer to initially prescribe high-quality generic drugs over originator drugs	25(2.4)	115(11.0)	361(34.5)	427(40.8)	119(11.4)
		Never	<10%	10–30%	30–60%	>60%
PB1	The proportion of prescriptions for high-quality generic drugs	253(24.2)	276(26.4)	232(22.2)	183(17.5)	103(9.8)
PB2	The proportion of prescriptions for high-quality generic drugs when both originator drugs and high-quality generic drugs are available in this hospital	246(23.5)	239(22.8)	229(21.9)	189(18.0)	144(13.8)

correlation coefficients involving that variable. Table S2 shows the square roots of the AVEs and correlation coefficients confirming the discriminant validity of latent variables in this model.

After revising according to the Bollen-Stine bootstrapping method, the overall structural model exhibited the following model fit indices: Normed Chi-square = 1.43, GFI = 0.985, AGFI = 0.977, CFI = 0.995, IFI = 0.995, RMSEA = 0.020 (Table 4).

The results of SEM are provided in Figure 2, the structural component of the model is highlighted by the directional paths in bold. The italicized values are the squared multiple correlations and are an indicator of the lower bound of reliability for that item. It is calculated by squaring the standardized coefficient.[40] ATT, SN, and PBC account for 74% of the variance in BI. BI and PBC account for 12% of the variability in PB scores.

Table 4 Goodness of Fit Indices

Fit indices	Tolerance range	Fit measure	Fit discrimination
Normed Chi-square	< 3.00	1.43	Pass[a]
GFI	> 0.90	0.985	Pass[a]
AGFI	> 0.90	0.977	Pass[a]
CFI	> 0.90	0.995	Pass[a]
IFI	> 0.90	0.995	Pass[a]
RMSEA	< 0.08	0.020	Pass[a]

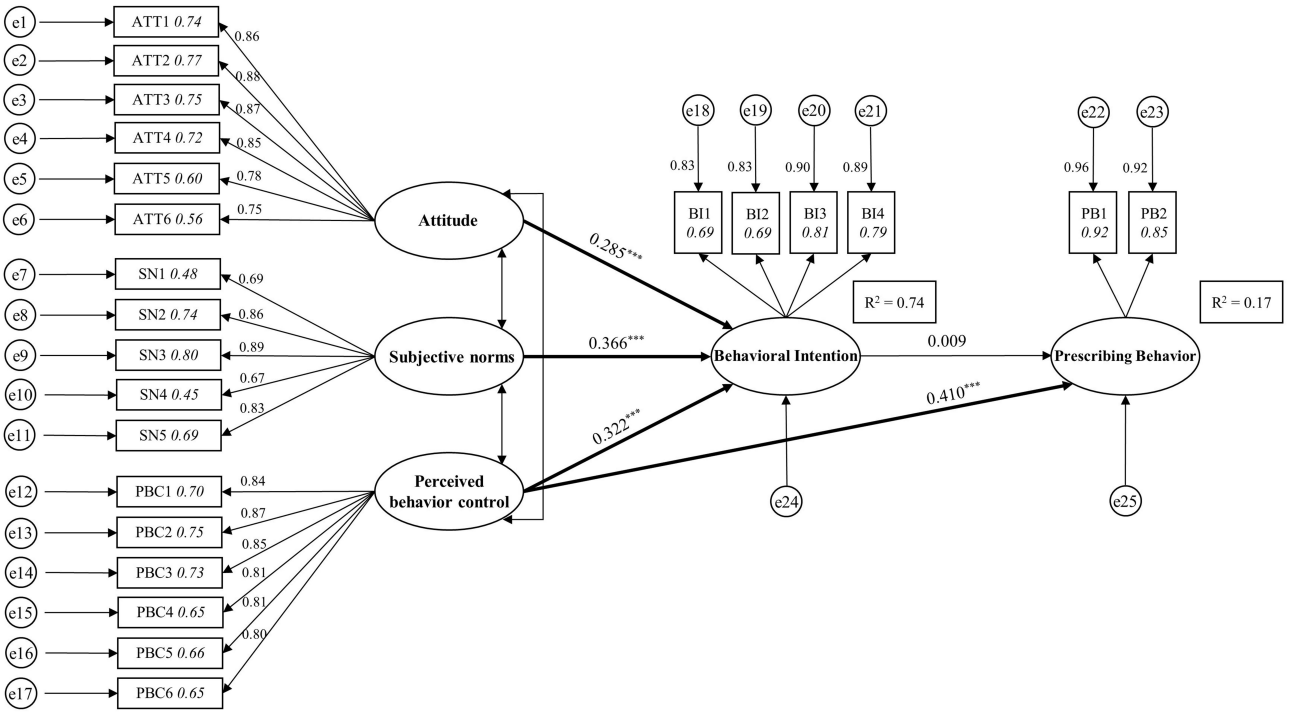

Figure 2 The results of SEM.
Notes: Path coefficients are bias-corrected coefficients from bootstrapping. Rectangles represent observed variables, ovals represent potential variables, and circles represent residual errors.

Table 5 shows bias-corrected path coefficients which were calculated by bootstrapping. These path coefficients for the effect of ATT, SN, and PBC on BI were 0.285, 0.366, and 0.322 respectively. The path coefficients for the effect of BI, and PBC on PB were 0.009 and 0.410 respectively.

Discussion

Physicians' knowledge of the Consistency Evaluation of Generic Drugs mark and related policies is relatively weak. Only 21.4%, 23.4%, and 21.1% of the surveyed physicians were able to recognize the mark "Passed the Consistency Evaluation of Quality and Efficacy of Generic Drugs" on drug packages, were familiar with the content of the Consistency Evaluation of Quality and Efficacy of Generic Drugs, and were aware that China had generic drug evaluation policies in place from 2012 to 2014. Additionally, a relatively high proportion of surveyed physicians responded with 'Disagree' and 'Hard to explain', indicating a lack of understanding of the consistency evaluation policy and related policies among physicians.

Table 5 Path Coefficients of the SEM

Paths of SEM	Unstandardized coefficient estimate	S.E.	Standardized coefficient estimate	Bias-corrected 95% CI	
ATT → BI	0.216	0.023	0.285	0.204	0.368
SN → BI	0.379	0.040	0.366	0.262	0.470
PBC → BI	0.258	0.026	0.322	0.231	0.412
BI → PB	0.018	0.100	0.009	−0.094	0.103
PBC → PB	0.646	0.082	0.410	0.314	0.498

Abbreviations: SEM, Structural equation model; ATT, Attitude; SN, Subjective norms; PBC, Perceived behavior control; BI, Behavioral intention; PB, Prescribing behavior; S.E, Standard error; CI, Confidence interval.

For the question regarding geometric mean ratio in bioequivalence studies, only 273 (26.1%) surveyed physicians answered correctly. Although this percentage was higher compared previous study conducted by Chua GN et al (2010)[41] (4.6%), Hassali MA et al (2014)[42] (4.0), and Kumar R et al (2015)[43] (3.6%) in Malaysian, it remained relatively low compared to the study of Dunne SS et al (2014)[44] in Ireland (88.2%). In general, physicians surveyed in this study demonstrated weak knowledge regarding the evaluation methods of consistency evaluation and bioequivalence studies. The findings of Kumar R et al (2015)[43] suggest that simple educational interventions can positively impact physicians' knowledge of generics, leading to improvement in their knowledge of regulatory requirements for bioequivalence (before intervention: 3.6%; after intervention: 32.1%), as well as improving their knowledge of generic bioequivalence, efficacy, and safety. Therefore, it is necessary to strengthen the dissemination and education of physicians' knowledge about the consistency evaluation policy and bioequivalence studies.

Physicians' attitudes toward high-quality generic drugs are generally positive. More than half of the surveyed physicians agreed that there is no difference in safety (56.1%) and clinical efficacy (50.3%) between high-quality generic drugs and originator drugs. 45.6% agreed that there is no difference in quality between high-quality generic drugs and originator drugs. Moreover, 49.4% of the respondents had a positive attitude towards the idea that "high-quality generic drugs can be substituted for originator drugs in clinical practice", which was slightly higher than that of another study conducted by Zhao M et al (2021).[45] The majority of surveyed physicians also had a positive attitude toward the policy of prioritizing the use of high-quality generic drugs.

Consistent with an existing study,[46] we found that young, highly educated physicians had a lower inclination to prescribe generics. A previous study has highlighted that physicians' attitudes toward and knowledge of generic drugs had a positive influence on generic prescribing.[45] Moreover, studies have shown that education interventions can play a critical role in enhancing physicians' knowledge of and confidence in prescribing generic.[47] Therefore, developing advocacy programs specifically targeted at promoting the utilization of generic drugs among young, highly educated physicians may be effective in influencing their prescribing behaviors.[48]

Limitation

Some of the strengths of this study are as follows. (1) It is one of the few studies that explores Chinese physicians' prescribing behavior for generic drugs, filling a gap in the existing literature. (2) It introduced TPB to enhance the logical organization, emphasizing psychological variables in understanding physicians' prescribing behaviors. (3) It employed SEM to analyze a complex model in its entirety, avoiding the need to split the model and thus providing a comprehensive analysis. Despite these strengths, several limitations should be noted. (1) The study relied solely on physicians' self-reports and did not directly observe their actual prescribing behaviors. (2) The economic disparities between the eastern, central, and western regions of China have been a longstanding issue in the country's history. (3) The number of respondents in this study may not adequately represent the entire nation's physicians. (4) Although 74% of the variance in BI was explained, there still was 83% of the unexplained variance of PB, suggesting the presence of other determinants, such as patient characteristics (eg socioeconomic status, type of medical insurance, and comorbidity,) that may also impact physician's decisions. (5) We provided training to the staff members of the scientific research department in these medical institutions and compensated them for their services. These trained staff members did not complete the questionnaires but were responsible for selecting physicians within the hospital for investigation. Therefore, the results may be influenced by the convenience sampling method and the subjective selection process conducted by the staff members.

Conclusion

Chinese physicians exhibit a positive attitude towards prescribing generic drugs, but their knowledge and actual prescriptions remain inadequate. The results support the notion that a more positive attitude, stronger subjective norms, and better perceived behavior control can enhance physicians' intentions to prescribe generics. Subjective norms and perceived behavior control were found to be more influential than attitude. However, it appears that the generic prescribing behavior is not under the volitional control of Chinese physicians, as their prescribing practice is likely to be affected by perceived strong control over prescribing generic drugs. Based on the results, the study suggests

the following interventions to promote generic prescribing among physicians. First, the authority could establish an interchangeable drugs list comprising high-quality generics recognized by professional organizations. Second, physicians should be offered with more comprehensive information regarding the safety, efficacy, and quality of high-quality generics. Future research should aim to integrate patient-related factors into the TPB framework in a systematic manner, such as patients' socioeconomic status and type of medical insurance.

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Disclosure

The authors report no conflicts of interest in this work.

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