Malaysian Journal of Medical Research, 10(4), 57-72
https://doi.org/10.31674/mjmr.2026.v010i04.07

MJMR
Malaysian Journal of Medical Research

Malaysian Journal of Medical Research

Online ISSN: 2550-1607

www.mjmr.com.my



Original Article

Knowledge of Generic and Branded Medicines and Self-Reported Purchasing of Generic Medicines Among Consumers of a Single Community Pharmacy in Linggang Bigung, Indonesia: A Cross-Sectional Study

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Abstract

Background: *Misconceptions about generic medicines can influence whether consumers buy them. This study examined the association between knowledge and self-reported purchasing of generic medicines among consumers of a single community pharmacy in Linggang Bigung, Indonesia, and whether age, education and visit frequency are related to purchasing directly or through knowledge.* ***Methods:*** *A cross-sectional survey was conducted among 310 consumers aged 17–59 years recruited by convenience sampling between 25th June and 6th August 2025. Knowledge was measured with 19 true/false/don't-know statements (net score −19 to +19) and purchasing with four yes/no items. Analyses used chi-square tests, Spearman correlation and partial least squares structural equation modeling (PLS-SEM) with percentile bootstrap 95% confidence intervals (CI).* ***Results:*** *The mean net knowledge score was 9.89 (SD 4.70), 52.1% of the maximum. Good practice was reported by 88.2% of respondents with high knowledge versus 57.1% of the others ($\chi^2 = 17.53$, $p < 0.001$; Cramér's $V = 0.238$). In PLS-SEM, knowledge was positively associated with purchasing ($\beta = 0.317$, 95% CI 0.215 to 0.415). Education was associated with purchasing only indirectly through knowledge (indirect effect 0.069, 95% CI 0.033 to 0.112), whereas visit frequency had a direct negative association ($\beta = -0.127$). R^2 was 0.061 for knowledge and 0.148 for purchasing.* ***Conclusions:*** *Knowledge was positive but modestly associated with self-reported generic-medicine purchasing, and the association of education with purchasing ran partly through knowledge. Given the cross-sectional design, single setting and limited explained variance, these findings are associative and require confirmation in multi-site studies.*

Keywords: *Community Pharmacy; Generic Medicines; Indonesia; Knowledge; Purchasing Practice*

Introduction

Generic medicines are promoted as cost-effective alternatives to branded products, yet misconceptions about their safety, efficacy and quality remain common among patients and the public (Colgan *et al*., 2015; Dunne & Dunne, 2015). Recent surveys show that limited public understanding of generic equivalence contributes to hesitation toward generic medicines despite regulatory assurances of quality (Alwhaibi *et al*., 2025; Jin & Kim, 2025). Reviews indicate that consumers' acceptance of generics is shaped by knowledge, price, brand familiarity, previous experience and the advice of health

professionals (Alrasheedy *et al*., 2014; Shrank *et al*., 2009), and that policies to promote generic use succeed only when they are accompanied by information for both professionals and patients (Hassali *et al*., 2014). Appropriate choice of medicines is part of the rational use of medicines promoted by the World Health Organization (WHO, 2002).

In Indonesia, the use of generic medicines is mandated in government health facilities (Ministry of Health of the Republic of Indonesia, 2010), but purchases at community pharmacies, particularly of non-prescription products, depend largely on the consumer's own choice and on information from pharmacy staff. Knowledge is therefore a plausible correlate of whether consumers buy generic medicines. Studies from Southeast Asia have shown that many consumers are unsure whether generic and branded medicines are equally effective (Wong *et al*., 2014), but evidence at the community-pharmacy level in rural districts of Indonesia remains limited, and it is unclear whether demographic characteristics are related to purchasing directly or indirectly through knowledge.

Research Objectives

This study aimed (1) to describe the demographic characteristics, knowledge and self-reported purchasing of generic medicines among consumers of Aasiyah Medika Pharmacy, Linggang Bigung; (2) to examine the association between knowledge and purchasing; and (3) to examine the direct and indirect (through knowledge) associations of age, education and visit frequency with purchasing, with gender and occupation examined separately.

Research Hypothesis

H_1: Higher knowledge is associated with more frequent self-reported purchasing of generic medicines.

H_2: Age, education, occupation and visit frequency are associated with knowledge.

H_3: These demographic variables are directly associated with purchasing.

H_4: Knowledge mediates the association between age, education and visit frequency and purchasing.

Methodology

Study Design, Setting and Period

A quantitative, observational, cross-sectional survey was conducted at a single community pharmacy, Aasiyah Medika Pharmacy, Linggang Bigung District, West Kutai Regency, East Kalimantan, Indonesia, from 25th June to 6th August 2025. No intervention was applied. The study is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies (von Elm *et al*., 2007); the completed checklist is provided as a supplementary file.

Participants, Sample Size and Sampling

Eligible participants were consumers who bought medicines at the pharmacy, were aged ≥ 17 and < 60 years, and were willing to complete the questionnaire. Consumers who could not read or understand the questionnaire, or who had physical or mental limitations, were excluded. Participants were recruited by accidental (convenience) sampling: during the study period, consumers visiting the pharmacy to buy medicines were invited by the researcher to take part. Consumers who agreed and could use a smartphone received a QR code at the pharmacy that opened the questionnaire in Google Form; those who could not complete it on a device received a printed questionnaire. So, offering two modes is an accepted way to reduce coverage problems when some respondents cannot use one mode (de Leeuw, 2005). Both versions were completed directly by the respondent at the pharmacy, with the researcher present to assist. The Google Form was accessible only through the QR code handed out at the pharmacy, so the 171 online respondents, like the 139 paper respondents, were consumers recruited in person at the pharmacy. In total, 310 consumers participated. The number of consumers who were invited but declined was not documented. so, the response rate could not be calculated; however, the response rate alone is a weak indicator of nonresponse bias (Groves & Peytcheva, 2008).

The sample size was first planned with Slovin's formula, $n = N / (1 + N \cdot e^2)$, using an estimated population of N = 1,200 consumers (from a preliminary review of pharmacy visit records) and e = 5%, giving n =

300. Because Slovin's formula does not address statistical power, the adequacy of the sample for PLS-SEM was checked with the inverse square root method (Kock & Hadaya, 2018): to detect a path coefficient of 0.15 at α = 0.05 with 80% power, $n \geq (2.486/0.15)^2 \approx 275$. A complementary power calculation for the largest regression in the structural model (four predictors of purchasing) gave n = 244 to detect $f^2 = 0.05$ at α = 0.05 with 80% power. The sample achieved of 310 exceeded both requirements; with n = 310 the smallest path coefficient detectable with 80% power is about 0.14, so smaller effects may have been missed.

Instruments and Measurement

Demographics

Gender, age group, highest education and occupation were recorded. Visit frequency was recorded with the question "This visit to Aasiyah Medika Pharmacy is your: first / second / third or later visit", i.e., the number of visits to this pharmacy including the current one, coded 1–3.

Knowledge

Knowledge was measured with 19 statements covering definition, regulation, effectiveness, price, examples of products and the role of health workers (Table 3). Respondents answered true, false or "don't know". A correct answer scored +1, an incorrect answer −1 and "don't know" 0, giving a net score from −19 to +19. The net score is the knowledge measure used throughout this article; it is also expressed as a percentage of the maximum possible score (net score/19 × 100). In the original analysis the score was rescaled as (score + 19)/38 × 100; on that scale a respondent who answers "don't know" to every item scores 50%, so the rescaled value is reported only for comparison. Because no external standard exists, knowledge was also categorized relative to the sample: high (> mean + 1 SD), moderate (mean ± 1 SD) and low (< mean − 1 SD) (Wijaya *et al*., 2024). These categories describe relative position within this sample and not absolute competence.

Purchasing Practice

In this study, "purchasing practice" means self-reported purchasing of generic medicines. It was measured with four yes/no items: recent purchase of a generic medicine (Y1), not refusing a generic medicine in favor of a more expensive branded one (Y2), a current tendency to buy generic medicines (Y3) and choosing a generic medicine directly when buying without a prescription (Y5) (Table 4). Purchasing of branded medicines was not measured. A fifth item (Y4) asked whether respondents were aware of the price difference between generic and branded medicines; it measures price awareness, not purchasing behavior.

Scores Used in Each Analysis

Two levels of measurement are used and are kept separate in the text and tables. (a) Descriptive and bivariate analyses (Tables 2, 5 and 6) use the 19-item net knowledge score and the 5-item practice score of the original instrument (Y1–Y5, range 5–10); respondents with a 5-item score ≥ the sample median (8) were classified as "good practice" and the others as "poor practice", a median-based, sample-relative classification. Because the 5-item score includes the price-awareness item, the bivariate analyses were repeated with the 4-item purchasing score (Y1, Y2, Y3, Y5; range 4–8), classified in the same way at its sample median (6). (b) The PLS-SEM uses the same 19-item net knowledge score as a single indicator and a 4-item purchasing construct (Y1, Y2, Y3, Y5); Y4 is excluded from the construct because it does not measure purchasing.

Validity and Reliability

Face and content validity were assessed by 30 raters (20 community members of Linggang Bigung and 10 pharmacists or pharmacy lecturers), who judged each item as relevant (1) or not relevant (0) on three criteria; all items obtained a proportion of 1.0, above the 0.79 criterion (Mousazadeh *et al*., 2017; Roy *et al*., 2023). Internal consistency is reported as one Cronbach's α per scale, computed on standardized item scores as in SmartPLS (Cronbach, 1951): 0.69 for the 19 knowledge items, 0.57 for the 5-item practice score and 0.65 for the 4-item purchasing construct. These values are modest, which

partly reflects the short scales. For the knowledge test, α is reported for description only, because knowledge was not modeled as a reflective construct (see below).

Statistical Analysis

Descriptive statistics were used for respondent characteristics. The association between knowledge category and practice category was tested with the Pearson chi-square test, and its strength with Cramér's V (weak 0.1–0.3, moderate 0.3–0.5 and strong > 0.5; Rea & Parker, 2014). As a complementary analysis that does not depend on the cut-offs, Spearman correlations between the net knowledge score and the practice scores were computed. The associations of gender and occupation with knowledge and practice categories were tested with chi-square tests.

Structural Model

PLS-SEM was used to estimate a model in which age, education and visit frequency predicted knowledge and purchasing, and knowledge predicted purchasing. Age group (1–4), education (0–4, from no schooling to diploma or higher) and visit frequency (1–3) are ordered categories and were entered as single-item constructs. Occupation is a nominal variable; in the earlier analysis it had been entered as a numeric code (1–5), which has no meaningful order. Because dummy coding would add four indicators based on small groups (e.g., civil servants, n = 31) to a model of limited power, occupation was removed from the PLS-SEM and analyzed with chi-square tests, as was gender.

Specification of Knowledge and Purchasing

Knowledge was modeled as a composite rather than as a reflective latent variable. The 19 statements cover distinct content areas, and a respondent may know one fact (e.g., that generics are cheaper) without knowing another (e.g., that generics can be produced after patent expiry); the items are therefore not interchangeable reflections of one underlying trait but together define the knowledge score, which corresponds to a composite (formative-type) rather than a reflective specification (Bollen & Lennox, 1991; Jarvis *et al*., 2003). The initial reflective model confirmed that the items did not behave reflectively (outer loadings −0.09 to 0.63; Average Variance Extracted (AVE) = 0.16; Tables 7 and 8). Knowledge was therefore entered as a single indicator equal to the net score of all 19 items. This keeps the full content of the test, avoids data-driven deletion of knowledge items, and makes the PLS-SEM knowledge measure identical to the one used in the bivariate analyses. Purchasing, whose items describe one behavioral tendency, was modeled as a reflective construct with Y1, Y2, Y3 and Y5.

Initial and Revised Models

In the initial model (SmartPLS 4; knowledge reflective with 19 items, practice reflective with 5 items, occupation entered as a numeric code), two practice items loaded below 0.40: Y4 (0.081) and Y1 (0.398). Y4 was excluded from the revised model on conceptual grounds, because it measures price awareness rather than purchasing. Y1 was retained because it is the only item that records an actual recent purchase of a generic medicine and is therefore central to the content of the construct, although its loading was slightly below 0.40 (0.398 in the initial model and 0.390 in the revised model). Hair *et al*. (2019) recommend removing indicators below 0.40; we retained Y1 for content validity because its loading was statistically significant (95% CI 0.120 to 0.586), and we report a sensitivity analysis without Y1. The revised model therefore differs from the initial model in three respects: knowledge as the 19-item net score, purchasing with four items, and occupation removed. Results of both models are reported (Tables 7–10).

Estimation and Inference

Indicators were standardized, and the path weighting scheme was used with a maximum of 3,000 iterations and a stop criterion of 10^{-7}. Path coefficients, specific indirect effects and outer loadings were tested with 5,000 bootstrap resamples. A single inference criterion was used throughout: an estimate was considered statistically significant when its two-tailed percentile bootstrap 95% confidence interval (CI) excluded zero; bootstrap p-values are therefore not used to judge significance. Mediation was interpreted following Zhao *et al*. (2010). The measurement model was evaluated with outer loadings, ρA, composite reliability (ρc), average variance extracted (AVE) and the heterotrait–monotrait (HTMT)

ratio (Hair *et al*., 2019; Henseler *et al*., 2015). The structural model was evaluated with variance inflation factors (VIF), R^2, f^2, the standardized root mean square residual (SRMR) and PLSpredict (10 folds, 10 repetitions; Q^2predict compared with a linear-model benchmark) (Hair *et al*., 2011; Shmueli *et al*., 2019).

Descriptive and chi-square analyses were performed in Microsoft Excel and SPSS version 25. Both PLS-SEM models were estimated in SmartPLS 4 (version 4.1.2.1; Ringle *et al*., 2024), with all indicators treated as metric. The SmartPLS PLS algorithm and bootstrapping output files of the initial and the revised model are provided as supplementary files. The sensitivity analysis without Y1 and PLSpredict were computed with the same PLS-SEM algorithm in Python, which reproduced the SmartPLS estimates of both models. A p-value < 0.05 was considered statistically significant for the chi-square tests and correlations.

Ethical Considerations

The study protocol received ethical clearance from the Health Research Ethics Committee of Universitas Muhammadiyah Lamongan, Indonesia with reference number 319/EC/KEPK–S2/09/2025, on 15th September 2025.

Results

Respondent Characteristics

A total of 310 consumers participated. Most were female (60.0%) and aged 17–35 years (68.7%). Senior secondary education was the most common level (45.5%), private employees formed the largest occupational group (32.6%), and two thirds of respondents (66.5%) were on their third or later visit (Table 1).

Table 1: Characteristics of Respondents (N = 310)

Variable	Category	N (Sample)	Percentage (%)
Gender	Female	186	60.0
	Male	124	40.0
Age (years)	17–25	118	38.1
	26–35	95	30.6
	36–45	56	18.1
	46–59	41	13.2
Education	No Schooling	5	1.6
	Primary	39	12.6
	Junior Secondary	47	15.2
	Senior Secondary	141	45.5
	Diploma/Undergraduate/Postgraduate	78	25.2
Occupation	Student	41	13.2
	Private Employee	101	32.6
	Civil Servant	31	10.0
	Entrepreneur	58	18.7
	Unemployed	79	25.5
Visit Frequency	First Visit	70	22.6
	Second Visit	34	11.0
	Third Visit or More	206	66.5

Knowledge and Purchasing Practice

The mean net knowledge score was 9.89 (SD 4.70; median 10; range −6 to 19) on a possible range of −19 to +19, i.e., 52.1% (SD 24.8%) of the maximum possible score. On average, respondents answered 12.95 of the 19 items (68.2%) correctly, 3.06 incorrectly and 2.99 with “don’t know”. On the rescaled percentage used in the original analysis, the mean was 76.0% (SD 12.4%); this value is not the proportion of correct answers, because a respondent answering “don’t know” to every item would score 50% on that scale. The sample-relative cut-offs for the net score were > 14.60 (high), 5.19–14.60

(moderate) and < 5.19 (low), giving 51 (16.5%), 203 (65.5%) and 56 (18.1%) respondents in the high, moderate and low groups, respectively. The median 5-item practice score was 8, and 193 respondents (62.3%) were classified as good practice and 117 (37.7%) as poor practice. The median 4-item purchasing score was 6 (mean 6.23, SD 1.38), and 198 respondents (63.9%) were classified as good purchasing and 112 (36.1%) as poor purchasing (Table 2). Because both classifications are relative to the sample distribution, the proportions should not be read as absolute levels of competence.

Table 2: Knowledge (19-item net score), Practice (5-item score) and Purchasing (4-item score) Categories

Variable	Category (cut-off)	N (Sample)	Percentage (%)
Knowledge (net score)	High (> 14.60)	51	16.5
	Moderate (5.19–14.60)	203	65.5
	Low (< 5.19)	56	18.1
Practice (5-item score, Y1–Y5)	Good (score ≥ 8)	193	62.3
	Poor (score < 8)	117	37.7
Purchasing (4-item score, Y1, Y2, Y3, Y5)	Good (score ≥ 6)	198	63.9
	Poor (score < 6)	112	36.1

Note: Cut-offs are sample-relative: knowledge = mean ± 1 SD of the net score; practice and purchasing = sample median.

At item level (Table 3), most respondents answered correctly that generic and branded medicines contain the same active ingredient (70.3%) and that generics are cheaper (73.9%). Misconceptions were evident for some items: only 29.0% correctly rejected the statement that generic medicines are of lower quality (60.0% answered incorrectly), only 28.4% correctly identified that Dumin and Promag are not generic medicines (54.8% answered incorrectly), and 47.4% correctly agreed that generic and branded medicines have the same effectiveness (40.3% answered incorrectly).

Table 3: Responses to the Knowledge Items, n (%)

No.	Statement	Correct	Incorrect	Don't know
K1	Generic medicines use the chemical (active-substance) name.	207 (66.8)	8 (2.6)	95 (30.6)
K2	Generic and branded medicines contain the same active ingredient.	218 (70.3)	51 (16.5)	41 (13.2)
K3	Branded medicines are named by the manufacturer and registered with BPOM.	257 (82.9)	13 (4.2)	40 (12.9)
K4	Generic medicines are cheaper than branded medicines.	229 (73.9)	41 (13.2)	40 (12.9)
K5	Generic and branded medicines have the same effectiveness.	147 (47.4)	125 (40.3)	38 (12.3)
K6	Generic medicines are part of a government medicine program.	216 (69.7)	29 (9.4)	65 (21)
K7	Generic and branded medicines are equally safe because both undergo quality control.	247 (79.7)	27 (8.7)	36 (11.6)
K8	Sanmol and paracetamol contain the same active ingredient.	280 (90.3)	13 (4.2)	17 (5.5)
K9	Generic medicines can be produced after the patent of the branded product expires.	121 (39)	43 (13.9)	146 (47.1)
K10	The color, shape and packaging of generic medicines may differ from branded ones.	268 (86.5)	15 (4.8)	27 (8.7)
K11	Generic medicines must have a marketing authorization from BPOM.	274 (88.4)	14 (4.5)	22 (7.1)
K12	Generic medicines can replace branded (patented) medicines because both are equally effective.	246 (79.4)	37 (11.9)	27 (8.7)
K13	Generic medicines can only be bought with a doctor's prescription. (False)	167 (53.9)	103 (33.2)	40 (12.9)

K14	Paracetamol and antacid are examples of generic medicines.	246 (79.4)	20 (6.5)	44 (14.2)
K15	Voltadex is an example of a branded medicine.	186 (60)	18 (5.8)	106 (34.2)
K16	Dumin and Promag are examples of generic medicines. (False)	88 (28.4)	170 (54.8)	52 (16.8)
K17	Generic medicines are of lower quality than branded medicines. (False)	90 (29)	186 (60)	34 (11)
K18	Generic medicines must be available in community health centers and public hospitals.	267 (86.1)	19 (6.1)	24 (7.7)
K19	Generic medicines can be recognized by the active-substance name on the package.	261 (84.2)	17 (5.5)	32 (10.3)

Note: Correct = +1, incorrect = −1, don't know = 0. Statements K13, K16 and K17 are false; all others are true.

For the practice items (Table 4), 87.1% of respondents were aware of the price difference between generic and branded medicines (Y4, price awareness), but fewer reported a tendency to buy generics (Y3, 48.1%) or to choose them directly when buying without a prescription (Y5, 51.3%).

Table 4: Practice Items: Responses Consistent with Buying Generic Medicines, n (%)

No.	Item	Consistent, n (%)
Y1	Recently bought generic medicine at a pharmacy (Yes = consistent).	187 (60.3)
Y2	Ever refused generic medicine and chose a branded one despite the higher price when buying without a prescription (No = consistent).	195 (62.9)
Y3	Currently tend to buy generic medicine when visiting a pharmacy (Yes = consistent).	149 (48.1)
Y4	Currently aware of the price difference between generic and branded medicines when buying (Yes = consistent). Price-awareness item; not part of the purchasing construct.	270 (87.1)
Y5	Currently choose generic medicine directly when buying without a prescription (Yes = consistent).	159 (51.3)

Note: Y1–Y3 and Y5 measure purchasing of generic medicines and form the 4-item purchasing score and the PLS-SEM purchasing construct; all five items form the 5-item practice score. Both scores are used in Tables 2, 5 and 6.

Association Between Knowledge and Purchasing Practice

Table 5 shows the cross-tabulation of knowledge category with practice and purchasing categories. Good practice (5-item score) was found in 88.2% of respondents with high knowledge, compared with 57.1% in both the moderate and low knowledge groups, which did not differ from each other. The pattern was almost identical with the 4-item purchasing score, which excludes price awareness: good purchasing was found in 88.2%, 59.1% and 58.9% of respondents with high, moderate and low knowledge, respectively. Overall, 62.3% of respondents had good practice and 63.9% had good purchasing.

Table 5: Cross-tabulation of Knowledge Category (net score) with Practice Category (5-item score) and Purchasing Category (4-item score)

Knowledge	Good n (row %)	Poor n (row %)	Total n	Good (row %)
(a) Practice, 5-item score (good ≥ 8)				
High	45 (88.2)	6 (11.8)	51	88.2
Moderate	116 (57.1)	87 (42.9)	203	57.1
Low	32 (57.1)	24 (42.9)	56	57.1
Total	193 (62.3)	117 (37.7)	310	62.3
(b) Purchasing, 4-item score (good ≥ 6)				
High	45 (88.2)	6 (11.8)	51	88.2
Moderate	120 (59.1)	83 (40.9)	203	59.1
Low	33 (58.9)	23 (41.1)	56	58.9
Total	198 (63.9)	112 (36.1)	310	63.9

Note: %- Percentage

Table 6 presents the tests of association. Knowledge category was significantly associated with practice category (Pearson $\chi^2 = 17.531$, $df = 2$, $p < 0.001$; likelihood ratio $\chi^2 = 20.236$, $p < 0.001$; Cramér's V = 0.238, a weak association). The results were almost identical with the 4-item purchasing score (Pearson $\chi^2 = 15.704$, $df = 2$, $p < 0.001$; likelihood ratio $\chi^2 = 18.159$, $p < 0.001$; Cramér's V = 0.225). Including Y4 therefore did not change the conclusion. Using the continuous scores, the net knowledge score was weakly to moderately correlated with the 5-item practice score (Spearman $\rho = 0.32$, $p < 0.001$) and with the 4-item purchasing score ($\rho = 0.31$, $p < 0.001$).

Table 6: Tests of Association between Knowledge and Practice (5-item score) and Purchasing (4-item score)

Statistic	*df*	Practice, 5-item Score	Purchasing, 4-item Score
Pearson χ^2	2	17.531 ($p < 0.001$)	15.704 ($p < 0.001$)
Likelihood Ratio χ^2	2	20.236 ($p < 0.001$)	18.159 ($p < 0.001$)
Cramér's V	–	0.238	0.225
Spearman ρ with Net Knowledge Score	–	0.32 ($p < 0.001$)	0.31 ($p < 0.001$)

Note: Chi-square tests are based on Table 5; Spearman ρ uses the continuous scores. All expected cell counts were ≥ 5.

Gender was not associated with knowledge ($\chi^2 = 0.564$, $df = 2$, $p = 0.754$) or practice ($\chi^2 = 0.826$, $df = 1$, $p = 0.363$). Occupation was not associated with knowledge category ($\chi^2 = 5.023$, $df = 8$, $p = 0.755$; Cramér's V = 0.090) but was associated with practice category ($\chi^2 = 14.592$, $df = 4$, $p = 0.006$; Cramér's V = 0.217, weak): good practice was most frequent among civil servants (25/31, 80.6%) and the unemployed (57/79, 72.2%) and least frequent among students (18/41, 43.9%); group sizes are given in Table 1.

Measurement and Structural Model (PLS-SEM)

Measurement Model

In the initial model, outer loadings ranged from −0.09 to 0.63 for knowledge (none ≥ 0.70; AVE = 0.16) and from 0.08 to 0.88 for practice (Table 7), confirming that the knowledge items did not form a reflective construct. In the revised model, knowledge is the single-indicator net score (loading fixed at 1).

Table 7:Outer Loadings in the Initial and Revised Models

Construct	Item	Initial model loading	Revised model loading (95% CI)	Decision
Knowledge	K1	0.545	–	In net score
	K2	0.629	–	In net score
	K3	0.414	–	In net score
	K4	0.049	–	In net score

	K5	0.584	–	In net score
	K6	0.432	–	In net score
	K7	0.337	–	In net score
	K8	0.336	–	In net score
	K9	0.430	–	In net score
	K10	0.086	–	In net score
	K11	0.514	–	In net score
	K12	0.259	–	In net score
	K13	−0.090	–	In net score
	K14	0.400	–	In net score
	K15	0.545	–	In net score
	K16	−0.037	–	In net score
	K17	0.241	–	In net score
	K18	0.408	–	In net score
	K19	0.335	–	In net score
	Net score (K1–K19)	–	1.000 (single indicator)	Single indicator
Purchasing	Y1	0.398	0.390 (0.120 to 0.586)	Retained (content validity)
	Y2	0.532	0.493 (0.181 to 0.679)	Retained
	Y3	0.881	0.875 (0.782 to 0.910)	Retained
Practice	Y4	0.081	–	Excluded (price awareness)
Purchasing	Y5	0.880	0.902 (0.791 to 0.959)	Retained

Note: initial model = SmartPLS 4 model with knowledge reflective (19 items), practice reflective (5 items) and occupation as a numeric code. Revised model = knowledge as the 19-item net score, purchasing reflective (Y1, Y2, Y3, Y5), occupation removed. K1–K19 and Y1–Y5 correspond to Tables 3 and 4. 95% CI = percentile bootstrap (5,000 resamples).

The loadings of the four purchasing items were 0.390 to 0.902 and all were significant (Table 7); ρA was 0.88, ρc 0.78 and AVE 0.49, just below the 0.50 criterion, so convergent validity of the purchasing construct is borderline (Table 8). The HTMT ratio between knowledge and purchasing was 0.38, supporting discriminant validity.

Table 8: Construct Reliability and Validity

Construct (model)	Items	Cronbach's α	ρA	ρc	AVE
Knowledge, initial (reflective)	19	0.69	0.68	0.72	0.16
Knowledge, revised (net score)	19 (one score)	0.69[a]	n/a	n/a	n/a
Practice, initial (reflective)	5	0.57	0.81	0.72	0.40
Purchasing, revised (reflective)	4	0.65	0.88	0.78	0.49

Note: Cronbach's α computed on standardized items (one value per scale, as in SmartPLS). [a] Internal consistency of the 19 items, reported for description only; reliability and AVE criteria for reflective constructs do not apply to a single-indicator composite. ρA = Dijkstra–Henseler reliability; ρc = composite reliability; AVE = average variance extracted. HTMT (knowledge–practice/purchasing) = 0.57 (initial) and 0.38 (revised). SRMR = 0.094 (initial) and 0.078 (revised).

Structural Model

Inner VIF values were ≤ 1.11, indicating no collinearity problem. The revised model is shown in Figure 1 and Table 9. Knowledge was positively associated with purchasing (β = 0.317, 95% CI 0.215 to 0.415; f^2 = 0.111, small to medium). Education was positively (β = 0.218, 95% CI 0.115 to 0.317; f^2 = 0.048) and visit frequency negatively (β = −0.126, 95% CI −0.232 to −0.011; f^2 = 0.016) associated with knowledge; age was not. Among the direct paths to purchasing, only visit frequency was significant (β = −0.127, 95% CI −0.238 to −0.014; f^2 = 0.018); the direct paths from education (β = 0.100, 95% CI −0.019 to 0.211) and age (β = 0.022, 95% CI −0.161 to 0.197) were not. The specific indirect effects through knowledge were significant for education (β = 0.069, 95% CI 0.033 to 0.112) and visit frequency (β = −0.040, 95% CI −0.079 to −0.003) but not for age. Following Zhao *et al*. (2010), this corresponds to indirect-only mediation for education and complementary partial mediation for visit frequency, in

which most of the association was direct. R^2 was 0.061 for knowledge and 0.148 for purchasing (adjusted 0.052 and 0.137), which is weak (Hair *et al*., 2011). SRMR was 0.078, below the 0.08 guideline. Predictive relevance was negligible: Q^2predict ranged from −0.006 to 0.044 across the five endogenous indicators, and PLS prediction errors were lower than those of the linear-model benchmark for only one of the five indicators.

Table 9: Structural Model: Path Coefficients, Specific Indirect Effects and Effect Sizes (Revised Model)

Path	*β*	95% CI	Significant (CI excludes 0)	f^2
Age → Knowledge	0.017	−0.095 to 0.131	No	0.000
Education → Knowledge	0.218	0.115 to 0.317	Yes	0.048
Visit frequency → Knowledge	−0.126	−0.232 to −0.011	Yes	0.016
Age → Purchasing	0.022	−0.161 to 0.197	No	0.001
Education → Purchasing	0.100	−0.019 to 0.211	No	0.011
Visit frequency → Purchasing	−0.127	−0.238 to −0.014	Yes	0.018
Knowledge → Purchasing	0.317	0.215 to 0.415	Yes	0.111
Age → Knowledge → Purchasing (indirect)	0.005	−0.031 to 0.043	No	–
Education → Knowledge → Purchasing (indirect)	0.069	0.033 to 0.112	Yes	–
Visit frequency → Knowledge → Purchasing (indirect)	−0.040	−0.079 to −0.003	Yes	–

Note: Standardized coefficients; CI = percentile bootstrap (5,000 resamples, two-tailed). Significance is judged only by whether the 95% CI excludes zero. f^2 ≈ 0.02, 0.15 and 0.35 are conventionally small, medium and large.

In figure 1 values are standardized path coefficients and outer loadings; * and solid arrows = percentile bootstrap 95% CI excludes zero (5,000 resamples). Indirect effects through knowledge: education 0.069*, visit frequency −0.040*, age 0.005.

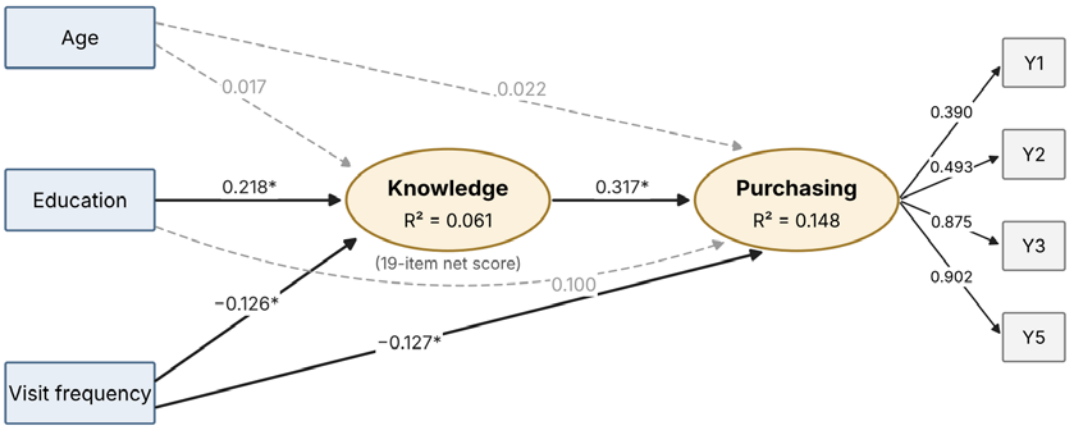


Figure 1: Revised PLS-SEM Structural Model: Age, Education and Visit Frequency, Knowledge (19-item net score) and Purchasing of Generic Medicines (Y1, Y2, Y3, Y5)

Comparison of the Initial and Revised Models

Table 10 compares the two models. The positive association between knowledge and purchasing (0.395 and 0.317), the positive association of education with knowledge and the indirect effect of education through knowledge were found in both models, and the direct path from education was not significant in either. In the initial model the direct path from occupation to practice was also not significant (95% CI −0.227 to 0.001). In the earlier, exploratory 10-item re-specification, the occupation CI did not include zero (−0.234 to −0.003); that model has been replaced, and occupation is now analyzed with chi-square tests (see above). The results for visit frequency depended on the specification. In the initial reflective model, its association with knowledge was stronger (−0.285 vs.

−0.126) and its direct path to practice was not significant (−0.042), whereas in the revised model the direct path was significant (−0.127). A likely reason is that the reflective model weighted most heavily the knowledge items most strongly related to the other constructs, whereas the net score weights all 19 items equally. In a sensitivity analysis without Y1 (purchasing = Y2, Y3, Y5), all conclusions were unchanged (knowledge → purchasing β = 0.325, 95% CI 0.221 to 0.420; education indirect 0.071, 95% CI 0.034 to 0.119; visit frequency direct −0.133, 95% CI −0.239 to −0.026).

Table 10: Comparison of the Initial and the Revised Models

Estimate	**Initial Model**	**Revised Model**
Knowledge → Practice/Purchasing	0.395 (0.307 to 0.514)	0.317 (0.215 to 0.415)
Education → Knowledge	0.252 (0.113 to 0.383)	0.218 (0.115 to 0.317)
Visit frequency → Knowledge	−0.285 (−0.423 to −0.144)	−0.126 (−0.232 to −0.011)
Age → Knowledge	−0.069 (−0.212 to 0.082)	0.017 (−0.095 to 0.131)
Education → Practice/Purchasing (direct)	0.098 (−0.017 to 0.198)	0.100 (−0.019 to 0.211)
Visit frequency → Practice/Purchasing (direct)	−0.042 (−0.135 to 0.076)	−0.127 (−0.238 to −0.014)
Age → Practice/Purchasing (direct)	0.108 (−0.056 to 0.265)	0.022 (−0.161 to 0.197)
Occupation → Practice (direct)	−0.113 (−0.227 to 0.001)	Not in model
Education → Knowledge → Practice/Purchasing	0.099 (0.044 to 0.166)	0.069 (0.033 to 0.112)
Visit frequency → Knowledge → Practice/Purchasing	−0.113 (−0.181 to −0.059)	−0.040 (−0.079 to −0.003)
R^2 knowledge	0.165	0.061
R^2 practice/purchasing	0.190	0.148
SRMR	0.094	0.078

Note: values are β (95% CI, percentile bootstrap, 5,000 resamples). Initial model: knowledge reflective (19 items), practice reflective (5 items), occupation as a numeric code. Revised model: knowledge = 19-item net score, purchasing reflective (Y1, Y2, Y3, Y5), occupation removed. Initial-model values are from the SmartPLS 4 bootstrapping output; revised-model values are from the SmartPLS 4 output of the revised model.

Table 11 presents the hypothesis tests. H_1 was supported: higher knowledge was associated with more frequent purchasing of generic medicines (β = 0.317, 95% CI 0.215 to 0.415). H_2, H_3 and H_4 were partly supported. Education and visit frequently, but not age or occupation, were associated with knowledge (H_2). Only visit frequency had a direct association with purchasing in the model, while occupation was

associated with practice in the unadjusted chi-square analysis only (H_3). Knowledge mediated the associations of education and visit frequency, but not age, with purchasing (H_4).

Table 11: Summary of Hypothesis Tests

Hypothesis	Supporting Statistic	Decision
H_1: Knowledge → Purchasing	β = 0.317 (95% CI 0.215 to 0.415); knowledge × practice χ^2 = 17.53, *df* = 2, $p < 0.001$; ρ = 0.32	Supported
H_2: Demographics → Knowledge	Education β = 0.218 (0.115 to 0.317); visit frequency β = −0.126 (−0.232 to −0.011); age β = 0.017 (−0.095 to 0.131); occupation χ^2 = 5.02, *df* = 8, p = 0.755	Partly supported (education, visit frequency)
H_3: Demographics → Purchasing (direct)	Visit frequency β = −0.127 (−0.238 to −0.014); education β = 0.100 (−0.019 to 0.211); age β = 0.022 (−0.161 to 0.197); occupation × practice χ^2 = 14.59, *df* = 4, p = 0.006 (unadjusted)	Partly supported (visit frequency; occupation in bivariate analysis only)
H_4: Mediation through Knowledge	Indirect effects: education 0.069 (0.033 to 0.112); visit frequency −0.040 (−0.079 to −0.003); age 0.005 (−0.031 to 0.043)	Partly supported (education, visit frequency)

Note: Decisions for PLS-SEM paths are based on whether the percentile bootstrap 95% CI excludes zero. Occupation was tested with chi-square tests only and is not adjusted for other variables.

Discussion

This study examined the association between knowledge of generic and branded medicines and self-reported purchasing of generic medicines among consumers of a single community pharmacy in rural Indonesia. Respondents obtained on average about half of the maximum possible net knowledge score (52.1%) and answered about two thirds of the items correctly, and item-level results showed persistent misconceptions: about six in ten respondents incorrectly accepted that generic medicines are of lower quality, and four in ten rejected equal effectiveness. This is consistent with reviews and surveys reporting that doubts about the quality and equivalence of generics persist among lay people (Alwhaibi *et al*., 2025; Colgan *et al*., 2015; Dunne & Dunne, 2015; Jin & Kim, 2025; Pavani *et al*., 2026) and with Malaysian data showing that only about half of patients considered generics as effective as branded medicines (Wong *et al*., 2014). The frequently incorrect answers to the brand-versus-generic classification item (K16) may also reflect that consumers commonly identify products by brand names.

Knowledge was positively associated with purchasing, but the association was weak by Cramér's V (0.238) and weak to moderate when the continuous scores were correlated (ρ = 0.31–0.32). The categorical analysis further showed that the difference lay between high knowledge and the rest: respondents with moderate and low knowledge had identical proportions of good practice (57.1%). Knowledge thus appears to be associated with practice mainly at higher levels, and the data do not support a steady gradient. This pattern fits the view that medicine choices are multifactorial and are influenced by trust, brand familiarity, price, the advice of pharmacy staff and perceived quality in addition to knowledge (Alrasheedy *et al*., 2014; Shrank *et al*., 2009). Because of the cross-sectional design, the direction of the association cannot be established; for instance, consumers who already buy generics may learn more about them.

The practice results also deserve careful reading. Almost nine in ten respondents were aware of the price difference, yet only about half reported a tendency to buy generics. Price awareness (Y4) was therefore analyzed separately from purchasing, and the results suggest that knowing that generics are cheaper does not by itself translate into buying them, which may reflect the trust issues described in other settings (Dunne & Dunne, 2015). A similar gap between awareness and practice was reported among healthcare professionals and students in India, where reasonable awareness of generics did not translate into consistent prescribing (Pavani *et al*., 2026). Practice was classified relative to the sample median, so the 62.3% classified as "good practice" indicates relative standing only. Occupation was associated with practice but not with knowledge in the bivariate analysis: civil servants most often

and students least often reported buying generics. This unadjusted association may reflect differences in income, health insurance or habitual sources of medicines, which were not measured.

In the structural model, education was positively associated with knowledge, consistent with the role of educational background in understanding medicine information, and the association of education with purchasing ran partly through knowledge (indirect effect 0.069; the direct effect, 0.100, was not significant). Visit frequency was negatively associated with both knowledge and purchasing. Only a small part of its association with purchasing ran through knowledge (indirect −0.040 vs. direct −0.127), and the size of these estimates depended on how knowledge was modeled . The negative associations of visit frequently were unexpected. A possible explanation, which was not tested in this study, is that repeat customers buy the same (often branded) product habitually and do not seek new information about alternatives. Alternatively, the pharmacy may serve different customer groups on first and later visits, and the data collection period coincided with a semester break, which may have affected the composition of student respondents. These interpretations should be treated as hypotheses. The explained variance was low (R^2 = 0.061 and 0.148), meaning that most of the variation in knowledge and purchasing is explained by factors not measured here, such as income, trust, attitudes, health insurance coverage and the availability of generic products.

The measurement results qualify these findings. In the initial reflective model, many knowledge items correlated weakly with the knowledge construct, which is expected for a set of heterogeneous true/false statements on definitions, regulation, price and product examples that do not form one unidimensional trait. Treating knowledge as the net score of all 19 items avoids deleting items after inspecting the data and keeps items with relevant content, such as the perceived lower quality of generics; the associations of knowledge with purchasing and of education with knowledge were similar in the initial and revised models, which suggests that they are not an artifact of the model specification, whereas the estimates for visit frequency were less stable. Model fit was acceptable (SRMR = 0.078), but AVE for purchasing was borderline (0.49) and predictive relevance was negligible (Q^2predict ≤ 0.044), so the model is better suited to describing associations than to predicting individual purchasing.

The findings may be relevant to pharmacy practice. Information and education for patients and pharmacy-based communication about equivalence and regulation have been suggested as ways to strengthen trust in generic medicines (Abdullah *et al*., 2025; Dunne & Dunne, 2015; Hassali *et al*., 2014). Our results, which are associative, suggest that such efforts could focus on specific misconceptions (such as the perceived lower quality of generics and product identification) and on repeat customers, but the effect of such interventions on purchasing was not tested here and should be evaluated in future studies.

Limitations

Three limitations should be considered. First, data were collected in two modes, an online questionnaire (n = 171) and a paper questionnaire (n = 139). Both were completed by the respondents themselves at the pharmacy with the researcher present, but the mode was chosen according to whether respondents could use a smartphone, so mode effects could not be separated from differences between the respondents who used each mode, and the researcher's presence may have encouraged socially desirable answers. Second, the number of consumers who were invited but declined to participate was not documented, so the response rate could not be calculated and non-response bias cannot be excluded, particularly because consumers more interested in medicines may have been more willing to take part. Third, the knowledge score has a built-in 50% baseline on the rescaled (score + 19)/38 scale, because "don't know" answers score zero rather than being penalized; the rescaled mean of 76.0% therefore overstates knowledge, and the net score (52.1% of the maximum) or the proportion of correct answers (68.2%) should be used when comparing this sample with other studies.

Conclusion

In this single-pharmacy sample of 310 consumers in Linggang Bigung, higher knowledge of generic and branded medicines was associated with more frequent self-reported purchasing of generic

medicines, although the association was weak to moderate and was clearest in the high-knowledge group. Education was related to purchasing partly through knowledge, and visit frequency was negatively related to both knowledge and purchasing, but the model explained only 14.8% of the variance in purchasing. Specific misconceptions, particularly about the quality of generic medicines, were common. Because of the cross-sectional design, the sample-relative classifications and the single setting, these findings are associative. Multi-site studies that measure purchasing of both generic and branded medicines, record response rates and include determinants such as trust, attitudes and income are needed.

Future Scope

Future research may include multiple pharmacies and older adults, use a single data collection mode or test for mode effects, use externally anchored cut-offs for knowledge and practice, develop the knowledge test into coherent sub-scales, measure purchasing of branded as well as generic medicines, and evaluate pharmacy-based educational interventions targeting the misconceptions identified here.

Conflict of Interest

The authors declare that they have no competing interests.

AI Declaration Assistance

The authors used Claude (Anthropic) for language editing and to check the statistical calculations. The PLS-SEM estimates of the initial and revised models were obtained in SmartPLS 4; the sensitivity analysis without Y1 and PLSpredict were computed in Python. The authors reviewed all content and take full responsibility for the manuscript.

CRediT Authorship Contribution Statement

N.A.S.P.: Conceptualization, methodology, investigation, data curation, formal analysis, writing – original draft. **H.W.:** Supervision, validation, writing – review and editing. **N.M.:** Supervision, validation, writing – review and editing.

Acknowledgement

The authors thank the staff of Aasiyah Medika Pharmacy, Indonesia, for their assistance during data collection and all respondents who participated in the study.

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