

Public's knowledge, attitude and practice regarding counterfeit medications in Malaysia

Kamaliah Md Saman^{1*}, Nur Irdina Redzuan²

¹ Department of Pharmacy Practice and Clinical, Faculty of Pharmacy, Universiti Teknologi MARA (UiTM), Puncak Alam Campus, 42300 Selangor, Malaysia.

² Faculty of Pharmacy, Universiti Teknologi MARA (UiTM), Puncak Alam Campus, 42300 Selangor, Malaysia.

ARTICLE INFO

Article history:

Received 14 March 2026

Revised 11 August 2026

Accepted 24 August 2026

Online first

Published 05 September 2026

Keywords:

Counterfeit medications,
Public,
Knowledge,
Attitudes and practices,
Healthcare

DOI:

10.24191/IJPNACs.v9i2.04

ABSTRACT

Counterfeit medications are drugs that are deliberately and fraudulently mislabelled with respect to their identity and source, which consequently poses a serious threat to public health and safety. This study aimed to assess the public's knowledge, attitudes, and practices regarding counterfeit medications in Malaysia, to identify sociology-demographic factors associated with their levels of knowledge, attitudes, and practices regarding counterfeit medications, and to determine the correlation among these variables. A questionnaire-based cross-sectional study was conducted using an online questionnaire among 389 participants across Malaysia. Data were analysed using descriptive statistics, Chi-square tests, multinomial logistic regression and Spearman's rho correlation. The findings revealed that 78.4% participants demonstrated good knowledge about counterfeit medications, while 97.2% exhibited positive attitudes, especially in recognising the economic impact of counterfeit drugs. In contrast, preventive practices were comparatively weaker, particularly behaviour related to reporting pharmaceutical products without a Meditag™ Hologram security sticker or product registration number to healthcare professionals, with 42.2% demonstrating neutral practices, 33.2% negative practices, and only 24.7% positive practices. Gender, age, employment status and monthly income were found to be significantly associated with knowledge levels ($p < 0.05$). Significant correlations were observed between knowledge and attitude, as well as between knowledge and practice. These findings not only highlight the importance of targeted awareness campaign, but support behavioural and public health strategies that strengthen medication-authenticity verification and reporting practices through coordinated efforts involving consumers, healthcare professionals, and regulatory authorities. The findings should nevertheless be interpreted considering the self-reported data and online recruitment approach. Future efforts should focus on translating knowledge and attitudes into safe, responsible practices.

^{1*}Corresponding author. E-mail address : kamaliah@uitm.edu.my

1. INTRODUCTION

Counterfeit medicines, also known as falsified medicines, pose an increasing global public health threat. World Health Organisation (WHO), has defined counterfeit medicines as drugs that are deliberately and fraudulently mislabelled regarding their identity, composition, or origin (Elkalmi et al., 2020). Such products may contain wrong ingredients, lack active pharmaceutical ingredients, have insufficient amounts of the active ingredient, or feature falsified packaging and labelling (El-Dahiyat et al., 2021). These issues can compromise treatment effectiveness and patient safety, potentially leading to treatment failure, adverse drug reactions, and higher rates of illness and death (El-Dahiyat et al., 2021). The counterfeit drugs represent about 1% of the pharmaceutical market in industrialised countries, but the figure can reach up to 30% in developing nations (Elkalmi et al., 2020), where regulatory oversight and supply chain monitoring are often weaker (Elkalmi et al., 2020), underscoring the widespread nature of this problem (Popoola et al., 2022). Several factors have contributed to the increasing proliferation of counterfeit medicines globally. These include the high price of legal drugs, restricted access to medical treatment, lax enforcement of regulations, and the quick growth of internet pharmacies (Hertig & Kennedy, 2023; Pathak et al., 2023; Feeney et al., 2024), availability of medications through unregulated channels, often without adequate quality control or regulatory monitoring (Siraj et al., 2022; Karungamye, 2023). The issue is further made worse by low public awareness and a lack of expertise about how to identify and report fake medications (Por et al., 2020; El-Dahiyat et al., 2021).

In Malaysia, the level of acceptable practice in identifying and reporting counterfeit items is still inadequate, despite previous research among the Malaysian public revealing intermediate levels of knowledge and positive attitudes about counterfeit medicines (Ong et al., 2020; Por et al., 2020). This disparity points to a possible gap in the public's knowledge, attitudes, and behaviours about fake medications. Developing effective measures to combat counterfeit medications requires an understanding of public perceptions and behaviours. The association between sociodemographic characteristics and the levels of knowledge, attitudes, and practices (KAP) among the Malaysian public is not well-established. Moreover, not enough research has been done on the relationship between these KAP domains.

Therefore, this study was conducted to assess the level of public KAP regarding counterfeit medications. In addition, the study aims to identify the association between socio-demographic characteristics and the levels of KAP related to counterfeit medicines, as well as to determine the correlation between these three domains. The findings of this study are expected to provide valuable insights into public awareness and behavioural patterns regarding counterfeit medicines, which may assist policymakers, healthcare professionals, and regulatory authorities in developing targeted educational and preventive strategies to reduce the circulation of counterfeit pharmaceutical products and improve public health outcomes.

Therefore, this study aimed to assess the Malaysian public's knowledge, attitudes, and practices regarding counterfeit medications, identify sociodemographic factors associated with these domains, and determine the relationships among knowledge, attitudes, and practices. Beyond describing public awareness, the study addresses the behavioural dimension of counterfeit-medication prevention by examining whether knowledge and favourable attitudes are reflected in appropriate preventive practices. This integrated assessment may provide useful evidence for policymakers, healthcare professionals, and regulatory authorities in developing more targeted strategies to strengthen medication verification and reporting behaviours among the Malaysian public.

2. METHODOLOGY

2.1 Design of the study and instrument

A prospective questionnaire-based cross-sectional study was conducted between April 2025 and June 2025 to evaluate the public's KAP regarding counterfeit medications. The questionnaire was adapted and modified from a previously validated instrument. The questionnaire consisted of four sections designed to comprehensively assess the public's KAP regarding counterfeit medications. Section A collected socio-demographic information to establish participants' profiles. Section B assessed respondents' knowledge regarding counterfeit medications using eight questions with response options of "Yes," "No," or "Unsure." Each correct answer was awarded one point, while incorrect or "Unsure" responses were assigned zero points. The total knowledge score ranged from 0 to 8 and was categorised as poor (0–2), moderate (3–5), or good (6–8). Section C evaluated respondents' attitudes toward counterfeit medications. Responses to the statements were measured using a five-point Likert scale with "strongly disagree" earning 1 point and "strongly agree" earning 5 points. The total attitude score ranged from 10 to 50 and was classified as negative (10–23), neutral (24–36), or positive (37–50). Section D assessed respondents' practices related to avoiding counterfeit medications. Responses to statements were rated on a four-point Likert scale ranging from "almost never" (1 point) to "always" (4 points). The total practice score ranged from 5 to 25 and was classified as negative (5–11), neutral (12–18), or positive (19–25). This scoring system enabled a comprehensive evaluation of the public's understanding, perceptions, and behaviours regarding CMs.

2.2 Sample size

Based on Malaysia's estimated 2024 population of approximately 34.1 million, the minimum required sample size was calculated using the Raosoft Online Sample Size Calculator. With a 95% confidence level and a 5% margin of error, the minimum sample size required was 385 participants. To account for potential non-responses or incomplete submissions, data were collected from 391 individuals initially. However, two respondents did not provide consent to participate in the study and were excluded, resulting in a final sample of 389 participants who voluntarily took part in the study.

2.3 Data collection and instrument validation

Data were collected using the structured questionnaire adapted for this study. The questionnaire used in this study was adapted and modified from a previously published instrument developed by Por et al. (2020). The questionnaire was modified to include both English and Malay language, to facilitate participation among the Malaysian public, whereby the questionnaire underwent translation procedure for the Malay version by linguistic validation. In this translation procedure, first a bilingual expert forward translated the questionnaire items followed by a second bilingual expert who then backward translated the questionnaire items. This was followed by bilingual expert review for the content validity, among 3 lecturers from the public university where the study was conducted. Upon the experts' feedback, modifications to the questionnaire were undertaken to ensure that the questionnaire was aligned with the objectives and context of the present study. Modifications made were changes to some words and omission of some items from

^{1*}Corresponding author. *E-mail address* : kamaliah@uitm.edu.my

the adapted questionnaire including omitting the last question regarding requesting public advice on the use of education to combat counterfeit and adulterated medicines.

The instrument's internal consistency reliability was assessed using Cronbach's alpha for all sections. The Cronbach's alpha values were 0.78 for the knowledge, also 0.78 for attitudes section and 0.81 for the practices section, indicating good internal consistency of the instrument. Cronbach's alpha values greater than 0.70 were considered acceptable, indicating satisfactory internal consistency among the items within each section. The questionnaire collected information on participants' socio-demographic characteristics and their KAP regarding counterfeit medications.

The survey was distributed online using Google Forms and promoted through various digital platforms, including WhatsApp, Telegram, Instagram, Facebook, email, and Quick Response (QR) codes, in order to maximise reach among the Malaysian public. Participation was voluntary, and the survey was conducted anonymously, with no personal identifying information collected. Completion and submission of the questionnaire were considered as implied consent to participate in the study.

2.4 Inclusion and exclusion criteria

Individuals aged 18 years and above who were currently residing in Malaysia were eligible to participate in this study. Participants who were unable to understand either Malay or English were excluded from the study. Additionally, individuals who were unable to provide consent or complete the questionnaire due to hospitalisation or medical conditions were also excluded from the study.

2.5 Data analysis

Data were analysed using IBM SPSS Statistics version 29. Descriptive statistics were used to summarise respondents' socio-demographic characteristics, and the results of KAP regarding counterfeit medications were presented as percentages and mean scores. Inferential statistical analyses, including the Chi-Square tests, were performed to examine the relationships between socio-demographic variables and KAP outcomes. A p-value of less than 0.05 was considered statistically significant.

Socio-demographic variables that showed significant associations were further analysed using multinomial logistic regression to identify predictors of KAP regarding counterfeit medications. In addition, Spearman's rho was used to assess the relationships among KAP. A p-value of less than 0.05 was considered to indicate a statistically significant correlation.

3. RESULTS

3.1 Sociodemographic characteristics of the participants

A total of 389 participants were included in the analysis. Females represented 58.9% (n = 229) of respondents, while 41.1% (n = 160) were male. The largest age group was 18–24 years (58.1%), followed by 25–39 years (26.2%), 40–54 years (12.1%), and >55 years (3.6%). Most participants held a bachelor's degree (62.2%), while 22.9% had a diploma and 9.8% a master's degree. Over half of the respondents (52.2%) were unemployed, and 44.7% reported no monthly income. Participants were distributed across Malaysia, with the highest proportion residing in Selangor (27.8%) (Table 1).

Table 1. Sociodemographic characteristics of the participants.

Socio-demographic parameter		Frequency (%)
Gender	Male	160 (41.1)
	Female	229 (58.9)
Age (years)	18 – 24	226 (58.1)
	25 – 39	102 (26.2)
	40 – 54	47 (12.1)
	> 55	14 (3.6)
Levels of education	No formal education	0 (0)
	Secondary school	16(4.1)
	Diploma	89 (22.9)
	Degree	242 (62.2)
	Master	38 (9.8)
	PhD	4 (1.0)
Employment status	Employed	178 (45.8)
	Unemployed	203 (52.2)
	Retired	8 (2.1)
Monthly income	< RM 1000	36 (9.3)
	RM 1000 – RM 3000	58 (14.9)
	RM 3000 – RM 5000	64 (16.5)
	>RM 5000	57 (14.7)
	NONE	174 (44.7)
Residence	Perlis	10 (2.6)
	Kedah	16 (4.1)
	Pulau Pinang	14 (3.6)
	Kelantan	37 (9.5)
	Terengganu	24 (6.2)
	Pahang	25 (6.4)
	Perak	30 (7.7)
	Selangor	108 (27.8)
	Melaka	17 (4.4)
	Johor	37 (9.5)
	Negeri Sembilan	19 (4.9)
	Sabah	18 (4.6)
	Sarawak	14 (3.6)
	Wilayah Persekutuan	20 (5.1)

3.2 Participants' knowledge, attitudes and practices regarding counterfeit medications

3.2.1 Knowledge

Overall, the majority of respondents demonstrated good knowledge regarding counterfeit medications (78.4%), while 20.1% exhibited moderate knowledge and 1.5% poor knowledge. High levels of correct responses were observed for several knowledge items. Most respondents recognised that counterfeit medicines compromise quality, efficacy and safety (95.1%), that the internet represents a major distribution channel for counterfeit medicines (96.4%), and that counterfeit medicines affect both developed and developing countries (97.2%), which yielded the highest knowledge score (mean = 0.97 ± 0.17). In contrast, awareness was substantially lower regarding the potential presence of counterfeit medicines within legitimate pharmaceutical supply chains. Only 51.1% of respondents correctly identified that counterfeit medicines may occur within licensed supply chains, representing the lowest knowledge score among the items (mean = 0.51 ± 0.50).

3.2.2 Attitudes

A positive attitude toward counterfeit medications was observed in 97.2% of respondents, while 2.8% reported neutral attitudes. No respondents demonstrated negative attitudes. The strongest agreement was observed for the statement that purchasing counterfeit medicines harms the national economy through loss of tax revenue (mean = 4.85 ± 0.60). Similarly high agreement was reported for statements regarding verification of Meditag™ hologram security stickers and product registration numbers (mean = 4.76 ± 0.50), as well as the importance of consulting pharmacists before purchasing pharmaceutical products (mean = 4.73 ± 0.53). The statement receiving the lowest agreement concerned avoidance of online pharmacies or drug retailers (mean = 4.07 ± 1.20), indicating greater variability in responses regarding online medicine purchasing.

3.2.3 Practices

It is particularly evident that although 78.4% of respondents demonstrated good knowledge and 97.2% demonstrated positive attitudes, only 24.7% exhibited positive practices, while 42.2% and 33.2% demonstrated neutral and negative practices, respectively. The highest reported practice score was associated with avoiding pharmaceutical products priced significantly lower than similar alternatives (mean = 3.31 ± 1.24). In contrast, the lowest scores were particularly evident for behaviours related to reporting suspected counterfeit medicines to healthcare professionals, including informing pharmacists or physicians when a Meditag™ hologram was absent (mean = 2.40 ± 1.28) or when a product registration number was missing (mean = 2.43 ± 1.29). These evidences formed one of the central findings of this paper (Table 2).

Table 2. Participants' knowledge, attitudes and practices scores regarding counterfeit medications.

A. Public's Knowledge regarding Counterfeit Medication	Response Frequency, N (%)			Score (Mean $\pm$ SD)
	Yes	No	Unsure	
A pharmaceutical product is counterfeit if its outer label or packaging does not have the Meditag™ Hologram security sticker.	311 (79.9%)	2 (0.5%)	76 (19.6%)	0.7995 $\pm$ 0.4009
A pharmaceutical product is counterfeit if its label does not display a registration number starting with the alphabets 'MAL'.	274 (70.4%)	11 (2.9%)	104 (26.7%)	0.7044 $\pm$ 0.4569
Are fake or altered medicines sold to make money?	350 (90%)	26 (6.7%)	13 (3.3%)	0.8997 $\pm$ 0.3007
Quality, efficacy and safety of counterfeit medications are not guaranteed.	370 (95.1%)	8 (2.1%)	11 (2.8%)	0.9512 $\pm$ 0.2158
The problem of counterfeit medications affects not only developed countries.	378 (97.2%)	4 (1 %)	7 (1.8%)	0.9717 $\pm$ 0.1659
Medicines for treating chronic diseases ('lifesaving medicines') such as heart disease or cancer can be counterfeited/ adulterated.	242 (62.2%)	86 (22.1%)	61 (15.7%)	0.6221 $\pm$ 0.4855
The Internet is one of the major platforms for circulating counterfeit medications	375 (96.4%)	6 (1.5%)	8 (2.1%)	0.9640 $\pm$ 0.1865
Counterfeit medicines can be found in the legal supply chain, such as through licensed wholesalers and traders.	199 (51.1%)	92 (23.7%)	98 (25.2%)	0.5116 $\pm$ 0.5005

B. Public's attitude regarding counterfeit medication	Response Frequency, N (%)					Score (Mean $\pm$ SD)
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
Counterfeit drugs are not as effective as authentic drugs	6 (1.5%)	1 (0.3%)	19 (4.9%)	83 (21.3%)	280 (72%)	4.6195 $\pm$ 0.7316
There is a high probability that the counterfeit drug doesn't work	3 (0.8%)	1 (0.3%)	5 (1.3%)	85 (21.9%)	295 (75.8%)	4.7172 $\pm$ 0.5808
I do not prefer to buy pharmaceutical products from online pharmacy/drug retailer	23 (5.9%)	24 (6.2%)	55 (14.1%)	87 (22.4%)	200 (51.4%)	4.0720 $\pm$ 1.1971
I avoid buying medicines from online pharmacies because I'm worried about counterfeit drugs.	5 (1.3%)	13 (3.3%)	39 (10%)	99 (25.4%)	233 (59.9%)	4.3933 $\pm$ 0.8922
I agree that it is important for consumers to consult pharmacist before buying any pharmaceutical products.	0 (0%)	1 (0.3%)	13 (3.3%)	76 (19.5%)	299 (76.9%)	4.7301 $\pm$ 0.5292
I agree that it is important to check for a pharmaceutical product to display Meditag™ Hologram security sticker and registration number on the label/packaging.	0 (0%)	1 (0.3%)	17 (4.4%)	77 (19.8%)	294 (75.6%)	4.7369 $\pm$ 0.5575
I agree that it is important for a pharmaceutical product to display Meditag™ Hologram security sticker and registration number on the label/packaging.	0 (0%)	1 (0.3%)	10 (2.6%)	72 (18.5%)	306 (78.7%)	4.7558 $\pm$ 0.5021
I should immediately inform my physician and pharmacist if I suspect that the pharmaceutical products are counterfeits.	0 (0%)	1 (0.3%)	23 (5.9%)	96 (69.2%)	269 (69.2%)	4.6272 $\pm$ 0.6069
I agree that using counterfeit medications will put my health at risk.	0 (0%)	1 (0.3%)	10 (2.6%)	61 (15.7%)	317 (81.5%)	4.7841 $\pm$ 0.4866
I agree that purchasing counterfeit medications will bring harm to the economy of the country through loss of taxation revenue.	0 (0%)	3 (0.8%)	17 (4.4%)	94 (24.2%)	275 (70.7%)	4.8478 $\pm$ 0.6023

C. Public's practice regarding counterfeit medication	Response Frequency, N (%)					Score (Mean $\pm$ SD)
	Almost never	Rarely	Sometimes	Often	Always	
I usually check if there is a Meditag™-Hologram security sticker on a pharmaceutical product before purchasing any pharmaceutical product.	44 (11.3%)	66 (17%)	139 (35.7%)	92 (23.7%)	48 (12.3%)	3.0874 $\pm$ 1.1610
I usually check if there is a registration number on the pharmaceutical product before purchasing any pharmaceutical product.	45 (11.6%)	70 (18%)	132 (33.9%)	94 (24.2%)	48 (12.3%)	3.0771 $\pm$ 1.1728
I inform the physician /pharmacist /drug retailer if there is no Meditag™ Hologram security sticker on a pharmaceutical product	125 (32.1%)	99 (25.4%)	76 (19.5%)	61 (15.7%)	28 (7.2%)	2.4036 $\pm$ 1.2779
I inform the physician /pharmacist /drug retailer if there is no registration number on a pharmaceutical product.	123 (31.6%)	99 (25.4%)	75 (19.3%)	61 (15.7%)	31 (8%)	2.4293 $\pm$ 1.2936
I do not buy the pharmaceutical product that is cheaper than other similar product regardless of the source.	40 (10.3%)	54 (13.9%)	123 (31.6%)	88 (22.6%)	84 (21.6%)	3.3136 $\pm$ 1.2433

The summary of levels of KAP is depicted in Fig. 1.

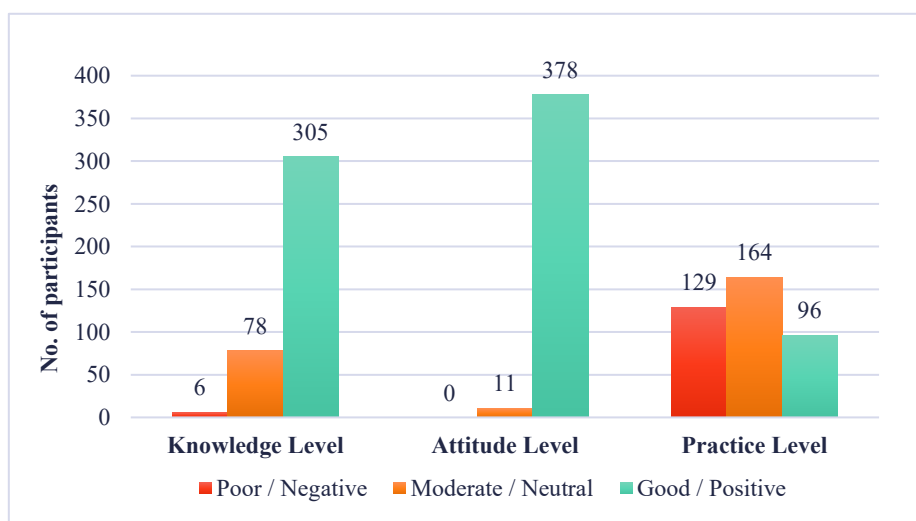


Fig. 1. Levels of public's knowledge, attitudes and practices regarding counterfeit medications.

3.2.4 Associations between socio-demographic characteristics with knowledge, attitudes and practices

Chi-square analysis revealed that knowledge level was significantly associated with gender ($\chi^2 = 21.593$, $p < 0.001$), age ($\chi^2 = 14.778$, $p = 0.022$), employment status ($\chi^2 = 28.609$, $p < 0.001$), and monthly income ($\chi^2 = 41.493$, $p < 0.001$). No statistically significant associations were observed between knowledge level and education level or residence ($p > 0.05$). Furthermore, attitudes and practices levels were not significantly associated with any socio-demographic variables examined (Table 3).

Table 3. Association between KAP with demographic characteristic of respondents.

Variables	Knowledge		Attitude		Practices	
	X ²	p-value	X ²	p-value	X ²	p-value
Gender	21.593	<0.001*	0.106	0.744	0.044	0.978
Age	14.778	0.022*	1.095	0.778	1.258	0.974
Education Level	5.831	0.666	1.594	0.810	9.070	0.336
Employment Status	28.609	<0.001*	4.019	0.134	0.883	0.927
Monthly Income	41.493	<0.001*	1.774	0.777	5.111	0.746
Residence	29.009	0.311	6.045	0.945	12.324	0.989

3.2.5 Predictors of knowledge regarding counterfeit medications

Multinomial logistic regression identified several predictors of knowledge level. Male respondents were significantly less likely than females to demonstrate moderate knowledge relative to good knowledge (OR = 0.266, 95% CI: 0.145–0.488, $p < 0.001$). Age was also significantly associated with knowledge level. Compared with respondents aged >55 years, younger age groups had significantly lower odds of demonstrating higher knowledge levels, including 18–24 years (OR = 9.566×10^{-8} , $p < 0.001$) and 25–39 years (OR = 7.747×10^{-8} , $p < 0.001$). Employment status was similarly associated with knowledge level. Unemployed respondents had significantly lower odds of moderate knowledge compared with retired participants (OR = 2.669×10^{-6} , $p < 0.001$). Monthly income was also associated with knowledge level. Participants with incomes of RM1,000–RM3,000 (OR = 0.454, $p = 0.048$), RM3,000–RM5,000 (OR = 0.123, $p < 0.001$), and >RM5,000 (OR = 0.090, $p = 0.001$) were significantly less likely to exhibit moderate knowledge compared with those reporting no income when good knowledge served as the reference category (Table 4).

Table 4. Multinomial logistic regression analysis of factors with knowledge.

Reference category: Good level of knowledge					
Poor level of knowledge Vs. Good level of knowledge	SE	df	OR	95%CI	p-value
Gender					
• Male	1.101	1	0.224	[0.026: 1.937]	0.174
• Female	ref				
Moderate level of knowledge Vs. Good level of knowledge					
Gender					
• Male	0.309	1	0.266	[0.145: 0.488]	<0.001*
• Female	ref				
R ² = 0.058 (Cox and Snell), 0.085 (Nagelkerke), X ² (2) = 23.316, *p-value <0.05					
Reference category: Poor level of knowledge					
Moderate level of knowledge Vs. Poor level of knowledge	SE	df	OR	95%CI	p-value
Age					
• 18 – 24	1.566	1	4.578e ⁻⁷	[2.128e ⁻⁸ : 9.848e ⁻⁶]	<0.001*
• 25 – 39	1.239	1	1.373e ⁻⁷	[5.534e ⁻⁹ : 3.408e ⁻⁶]	<0.001*
• 40 – 54	0.000	1	1.144e ⁻⁷	[1.223e ⁻⁸ : 1.070e ⁻⁶]	<0.001*
• > 55	ref				
Good level of knowledge Vs. Poor level of knowledge					
Age					
• 18 – 24	1.168	1	9.566e ⁻⁸	[9.697e ⁻⁹ : 9.436e ⁻⁷]	<0.001*
• 25 – 39	1.239	1	7.747e ⁻⁸	[6.827e ⁻⁹ : 8.790e ⁻⁷]	<0.001*
• 40 – 54	0.000	1	7.218e ⁻⁸	[7.218e ⁻⁹ : 7.218e ⁻⁹]	. ^b
• > 55	ref				
R ² = 0.040 (Cox and Snell), 0.059 (Nagelkerke), X ² (6) = 15.936, *p-value <0.05					

Reference category: Good level of knowledge

Moderate level of knowledge Vs. Poor level of knowledge	SE	df	OR	95%CI	p-value
Employment status					
• Employed	409.439	1	0.819	[0.00: 0.00]	1.00
• Unemployed	1.080	1	2.669e ⁻⁶	[3.212e ⁻⁷ : 2.218e ⁻⁵]	<0.001*
• Retired	ref				
Good level of knowledge Vs. Poor level of knowledge					
Employment status					
• Employed	409.437	1	1.040	[0.00:00]	1.00
• Unemployed	. ^b	1	0.910e ⁻⁷	[8.919e ⁻⁷ : 8.919e ⁻⁷]	. ^b
• Retired	ref				

$R^2 = 0.079$ (Cox and Snell), 0.115 (Nagelkerke), $X^2(4) = 31.904$, *p-value <0.05

Reference category: Poor level of knowledge

Poor level of knowledge Vs. Good level of knowledge	SE	df	OR	95%CI	p-value
Monthly income					
• < RM 1000	1.144	1	1.512	[0.161:14.233]	0.718
• RM 1000 – RM 3000	. ^b	1	3.045e ⁻⁹	[3.045e ⁻⁹ : 3.045e ⁻⁹]	. ^b
• RM 3000 – RM 5000	1.129	1	0.504	[0.055: 4.610]	0.544
• >RM 5000	. ^b	1	2.465e ⁻⁹	[2.465e ⁻⁹ : 2.465e ⁻⁹]	. ^b
• None	ref				
Moderate level of knowledge Vs. Good level of knowledge					
Monthly income					
• < RM 1000	0.381	1	1.852	[0.161:14.233]	0.106
• RM 1000 – RM 3000	0.400	1	0.454	[3.045e ⁻⁹ : 3.045e ⁻⁹]	0.048*
• RM 3000 – RM 5000	0.615	1	0.123	[0.055: 4.610]	<0.001*
• >RM 5000	0.739	1	0.090	[2.465e ⁻⁹ : 2.465e ⁻⁹]	0.001*
• None	ref				

$R^2 = 0.116$ (Cox and Snell), 0.170 (Nagelkerke), $X^2(8) = 48.088$, *p-value <0.05

SE: standard error, df: degree of freedom, OR: odd ratio, CI: confidence interval, X^2 : chi-square test.

3.2.6 Correlation between knowledge, attitudes and practices

Knowledge showed a moderate positive correlation with attitude ($\rho = 0.401$, $p < 0.001$), suggesting that respondents with greater understanding of counterfeit medications tended to hold more favourable attitudes toward their prevention. However, the association between knowledge and preventive practice was considerably weaker ($\rho = 0.149$, $p = 0.003$). Furthermore, attitude was not significantly correlated with practice ($\rho = 0.075$, $p = 0.139$). Collectively, these findings suggest that knowledge and favourable perceptions alone may be insufficient to ensure the adoption of appropriate preventive behaviours. These correlation findings further demonstrate a discrepancy between awareness and behavioural implementation (Table 5).

Table 5. Correlations respondents' level of KAP regarding CMs.

	Knowledge	Attitude	Practice
Knowledge	1.00	$\rho = 0.401$, $p < 0.001$ *	$\rho = 0.149$, $p = 0.003$ *
Attitude	$\rho = 0.401$, $p < 0.001$ *	1.00	$\rho = 0.075$, $p = 0.139$
Practice	$\rho = 0.149$, $p = 0.003$ *	$\rho = 0.075$, $p = 0.139$	1.00

ρ = Spearman's coefficient

* - significant with $p < 0.05$

4. DISCUSSION

4.1 Knowledge

The present study examined the level of public knowledge regarding counterfeit medications in Malaysia and found that the majority of participants (78.4%) demonstrated a good level of knowledge. This finding suggests a relatively high level of awareness among the Malaysian public regarding the risks and characteristics of counterfeit medicines. Comparable results have been reported in previous Malaysian studies. For instance, a study by Ong et al. (2020) found that more than half of respondents were aware of unregistered medications and recognised the importance of proper drug registration under the National Pharmaceutical Regulatory Agency (NPRA). Similarly, Mohd Nawi et al. (2020) reported that most respondents demonstrated adequate knowledge regarding unregistered medicines. Collectively, these findings suggest that ongoing regulatory efforts and public awareness initiatives in Malaysia may have contributed to improving public understanding of counterfeit pharmaceuticals.

However, the level of knowledge observed in the current study appears higher than that reported in other local research. For example, Por et al. (2020) reported that the general population in Kuala Lumpur demonstrated only moderate knowledge regarding counterfeit and falsified medications. Differences between studies may reflect variations in sampling strategies, sociodemographic characteristics of participants, or differences in exposure to health information campaigns. Increased digital access to health information and greater media attention toward counterfeit medicines in recent years may also have contributed to the improved knowledge observed in the present study.

Analysis of individual knowledge items revealed that the highest level of agreement was observed for the statement indicating that counterfeit medicines are not limited to developing countries but represent a global issue ($\text{Mean} = 0.9717 \pm 0.1659$). This finding suggests that respondents are aware of the widespread nature of the counterfeit drug problem. Evidence from international literature supports this perception. For instance, Feeney et al. (2024) highlighted that counterfeit medicines are encountered in multiple regions worldwide. In particular, countries in Sub-Saharan Africa, including Nigeria and the Democratic Republic of the Congo, have reported substantial circulation of falsified medicines, especially antimalarials and antibiotics. Similarly, several Southeast Asian countries, including Myanmar and Cambodia, have been identified as potential sources of falsified pharmaceutical products due to regulatory and supply-chain vulnerabilities. These findings reinforce the perception that counterfeit medicines represent a transnational public health challenge requiring coordinated regulatory responses (Feeney et al., 2024).

In contrast, the lowest knowledge score was observed for the statement indicating that counterfeit medicines may enter the legal pharmaceutical supply chain through licensed wholesalers or distributors ($\text{Mean} = 0.5116 \pm 0.5005$). This suggests that many participants may underestimate the complexity of pharmaceutical supply chains and the potential for counterfeit products to infiltrate regulated distribution systems. Similar concerns have been highlighted in international research. For example, Padma and Ramaiah (2024) emphasised that pharmaceutical supply chains face persistent challenges related to counterfeit detection, limited transparency, inadequate monitoring mechanisms, and security vulnerabilities. These weaknesses may enable falsified medicines to circulate within legitimate supply networks, thereby posing significant risks to patient safety and healthcare systems (Padma & Ramaiah, 2024). Addressing this knowledge gap may be important for strengthening public vigilance and encouraging safer medication purchasing behaviours, particularly in the context of increasing online pharmaceutical sales.

4.2 Attitudes

The present study demonstrated that the vast majority of participants (97.2%) exhibited a positive attitude toward counterfeit medications, indicating strong public recognition of the risks associated with their use. This high level of risk perception suggests that respondents generally acknowledge the potential health, safety, and societal consequences of counterfeit pharmaceutical products. Similar findings have been reported in other studies examining public attitudes toward counterfeit medicines. For example, Wagiealla et al. (2022) reported that approximately 68% of respondents demonstrated a positive attitude toward avoiding counterfeit medications, reflecting growing public awareness of the dangers posed by falsified pharmaceutical products.

Among the attitude-related statements, the highest level of agreement was observed for the statement indicating that purchasing counterfeit medications may harm the national economy through the loss of taxation revenue ($\text{Mean} = 4.8478 \pm 0.6023$). This finding suggests that respondents not only recognize the health risks associated with counterfeit medicines but also understand their broader economic implications. International evidence supports this perspective. A modelling study by Beargie et al. (2019) estimated that substandard and falsified antimalarial medicines contributed to approximately USD 892 million in annual economic losses in Nigeria. In addition to financial losses, counterfeit medicines were estimated to account for 6–23% of the overall health and economic burden associated with malaria in the

country. These findings highlight the multidimensional impact of counterfeit medicines, extending beyond patient safety to encompass national economic stability and healthcare system sustainability.

Participants also expressed strong agreement with statements emphasizing the importance of consulting pharmacists and verifying medication authenticity through official security indicators such as the Meditag™ Hologram Security Sticker (mean = 4.7301 ± 0.5292) and the National Pharmaceutical Regulatory Agency (NPRA) registration number, commonly known as the MAL number (mean = 4.7369 ± 0.5575 and 4.7558 ± 0.5021). These responses underscore the perceived role of pharmacists as trusted healthcare professionals in protecting consumers from counterfeit medicines. Previous research supports the critical role of pharmacists in this context. For instance, Pathak et al. (2023) emphasized that pharmacists play a key role in identifying and reporting suspected counterfeit products, maintaining pharmaceutical traceability, and educating patients about safe medication use. In parallel, patients themselves contribute to safeguarding the medication supply chain by consulting healthcare professionals when they encounter unusual product characteristics or suspect counterfeit products. The strong agreement observed in this study therefore reflects a shared responsibility between healthcare professionals and consumers in combating counterfeit medicines.

In contrast, the statement “I do not prefer to buy pharmaceutical products from online pharmacies or drug retailers” received the lowest mean score (Mean = 4.0720 ± 1.1971). Although respondents generally expressed caution regarding counterfeit medicines, the comparatively lower score and larger variability suggest more diverse attitudes toward online pharmaceutical purchasing. This finding likely reflects evolving consumer behaviour in the context of digital health services. On one hand, studies such as Almohammed et al. (2023) and Suzanna et al. (2021) reported that many individuals prefer purchasing medications from physical pharmacies, where they can verify product authenticity and receive professional consultation directly from pharmacists. On the other hand, research by Ocicka (2021) and Godiyal and Mishra (2025) indicates that the increasing accessibility of online marketplaces has significantly influenced consumer purchasing patterns, with more individuals opting to purchase health products through digital platforms. The expansion of online pharmaceutical sales offers convenience and wider access to medicines but also increases the risk of exposure to counterfeit products, especially when purchases are made from unregulated sources.

4.3 Practices

Despite the generally favourable levels of knowledge and attitudes observed among respondents, the findings of the present study indicate that actual preventive practices toward counterfeit medications remain suboptimal. Participants demonstrated practices ranging from neutral to poor when engaging in behaviours intended to verify medication authenticity. This discrepancy between knowledge, attitudes, and practices suggests that awareness of counterfeit medicines does not necessarily translate into appropriate consumer behaviour. Similar patterns have been reported in other studies assessing public responses to counterfeit pharmaceuticals. For example, Suzanna et al. (2021) found that preventive practices among consumers were relatively limited, with only 34.9% of respondents reporting that they routinely checked medication barcodes on product labels. Such findings highlight a persistent gap between knowledge and real-world preventive behaviours.

In the present study, the mean scores for two important safety verification practices—checking for the Meditag™ Hologram Security Sticker and verifying the medication registration number issued by the

National Pharmaceutical Regulatory Agency (NPRA), commonly referred to as the MAL number—were moderate (Mean = 3.0874 ± 1.1610 and 3.0771 ± 1.1728 , respectively). These results suggest that although some individuals engage in verification behaviours, such practices are not consistently adopted by the wider public. A possible explanation for this pattern is the limited consumer familiarity with pharmaceutical authentication mechanisms. Research by Elkalmi et al. (2020) emphasised that insufficient consumer awareness can lead individuals to assume that medications are legitimate, particularly when counterfeit products closely resemble authentic pharmaceutical products. Consequently, the absence of routine verification behaviours may increase the likelihood of unknowingly consuming counterfeit medicines (Elkalmi et al., 2020).

Furthermore, the study revealed particularly low scores for behaviours related to reporting suspicious medications to healthcare professionals. Only a small proportion of respondents indicated that they would notify a pharmacist, physician, or drug retailer if a product lacked an official hologram or registration number. These findings indicate a limited tendency among consumers to engage in active reporting or pharmacovigilance behaviours. Similar observations were reported by El-Dahiyat et al. (2021), in which only 2.6% of respondents had ever reported suspected counterfeit medicines to the appropriate authorities. This low reporting rate may reflect a lack of awareness regarding reporting mechanisms, uncertainty about identifying counterfeit products, or limited confidence in regulatory enforcement systems. Strengthening public awareness regarding these reporting channels may therefore represent an important strategy for improving pharmacovigilance. In contrast, recommendations from study by Pathak et al. (2023), emphasise that patients should promptly contact a pharmacist or physician if they notice any discrepancies in the appearance, taste or effects of the medications they are using.

4.4 Correlation between knowledge, attitudes and practices

A significant positive correlation was observed between knowledge and attitude ($\rho = 0.401$, $p < 0.001$), indicating that higher knowledge levels were associated with more appropriate attitudes toward counterfeit medications. Similarly, knowledge was significantly correlated with practice, ($\rho = 0.149$, $p = 0.003$), suggesting that respondents with better knowledge tended to demonstrate safer practices related to counterfeit medication avoidance, even though the correlation is weak which explains the earlier mentioned gap. However, no significant correlation was identified between attitude and practice ($\rho = 0.075$, $p = 0.139$), indicating that attitudes toward counterfeit medications did not necessarily translate into corresponding preventive practices among the respondents.

4.5 Socio-demographic independently associated factors of knowledge

Several socio-demographic factors were found to influence participants' knowledge regarding counterfeit medications with gender emerging as a significant variable. Female participants demonstrated higher knowledge levels compared to males. This finding contrasts with the study by El-Dahiyat et al. (2021), which reported greater knowledge among male participants in identifying counterfeit medications.

Age was also significantly associated with knowledge level, with participants aged above 55 years demonstrating better knowledge compared to younger respondents. This may suggest that increased age is linked to greater awareness or exposure to medication-related issues. A similar association was reported by El-Dahiyat et al. (2021), where older participants demonstrated better understanding ($p = 0.016$).

Employment status was another factor influencing knowledge levels. In this study, unemployed participants showed lower knowledge regarding counterfeit medications compared to retired individuals. In contrast, a study by Worku et al. (2024) in Gondar City reported high awareness of counterfeit and substandard pharmaceutical products among professional pharmacists, suggesting that employment in healthcare-related fields may contribute to greater knowledge.

Monthly income was also associated with knowledge levels, with higher-income participants demonstrating better knowledge compared to those with lower income. This finding is supported by Mohd Nawi et al. (2020), who highlighted that economic circumstances may influence medicine purchasing decisions. However, Por et al. (2020) reported that monthly income did not significantly affect knowledge regarding counterfeit medications.

The observed gap between knowledge and preventive practices has important implications for relevant stakeholders. Interventions should therefore extend beyond awareness-building and address practical barriers to medication verification and reporting. In this respect, regulatory authorities may strengthen public-facing education on practical methods for verifying pharmaceutical products and provide clear, accessible channels for reporting suspected counterfeit medicines. Pharmacists and other healthcare professionals can reinforce these measures by routinely educating consumers on medication-authenticity verification and encouraging prompt reporting of suspicious products. Public health initiatives should therefore extend beyond increasing awareness of counterfeit medicines and incorporate behavioural strategies that facilitate routine verification and reporting. Consumers should also be encouraged to obtain medicines through legitimate sources, verify relevant product-security and registration information, and seek professional advice when product authenticity is uncertain. Coordinated action across these stakeholder groups may help translate existing public knowledge and favourable attitudes into safer medication-related behaviours.

This study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design identifies associations between variables but does not establish temporal or causal relationships. Second, the findings were based on self-reported responses and may therefore be affected by recall or social desirability bias. Third, recruitment through an online questionnaire and digital platforms may have preferentially reached individuals with greater internet access and digital literacy. The sample also contained a relatively high proportion of younger participants, which may limit the generalisability of the findings to the broader Malaysian population. Future studies employing probability-based sampling and more demographically representative populations are warranted to confirm these findings. We suggest to investigate the determinants underlying the observed knowledge–practice gap. Intervention-based research is also warranted to determine whether targeted consumer education and medication-verification initiatives can translate knowledge and positive attitudes into sustained preventive behaviours.

5. CONCLUSION

This study demonstrated that the Malaysian public generally had good knowledge and positive attitudes regarding counterfeit medications, but these were not consistently translated into appropriate preventive practices. In particular, medication-authenticity verification and reporting of suspected counterfeit products remained suboptimal. The findings highlight the need for targeted behavioural interventions that strengthen

consumers' verification and reporting practices, supported by coordinated efforts among healthcare professionals, regulatory authorities, and the public.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge Universiti Teknologi MARA (UiTM) for their invaluable support in providing the facilities necessary for conducting the study. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

CONFLICT OF INTEREST STATEMENT

The authors declared that they have no conflicts of interest to disclose.

AUTHORS' CONTRIBUTIONS

Nur Irdina Redzuan: Data analysis, methodology, formal analysis, writing—original draft. **Kamaliah Md Saman:** Resources, visualization, draft corrections, supervision, writing – review & editing.

DECLARATION OF GENERATIVE AI IN THE WRITING PROCESS

During the preparation of this work, the authors used ChatGPT (OpenAI) solely for language refinement and improvement of manuscript readability. The authors reviewed and edited all generated content and take full responsibility for the content of this publication.

ETHICS STATEMENT

Ethical approval for this study was obtained from the Research Ethics Committee of the Faculty of Pharmacy, Universiti Teknologi MARA (UiTM) with the reference number REC (PH)/UG/152/2024 (MR) dated 15 February 2025 prior to the commencement of data collection. Participation in this study was entirely voluntary. Participants were informed about the purpose of the study, and completion of the online questionnaire was considered as implied consent to participate. The survey was conducted anonymously, and no personal identifying information was collected. All responses were treated with strict confidentiality and were used solely for research purposes.

REFERENCES

- Almohammed, O. A., Alnogaidan, R. A., Ghannam, F. O., Alqahtani, R. S., Aloraini, S. K., & Abanmy, N. O. (2023). Public awareness of online pharmacies, consumers' motivating factors, experience and satisfaction with online pharmacy services, and current barriers and motivators for non-consumers: The case of Saudi Arabia. *Saudi Pharmaceutical Journal*, 31(8), 101676. <https://doi.org/10.1016/j.jsps.2023.06.009>
- Beargie, S. M., Higgins, C. R., Evans, D. R., Laing, S. K., Erim, D., & Ozawa, S. (2019). The economic

- impact of substandard and falsified antimalarial medications in Nigeria. *PLoS ONE*, 14(8), e0217910. <https://doi.org/10.1371/journal.pone.0217910>
- El-Dahiyat, F., Faehelelbom, K. M. S., Jairoun, A. A., & Al-Hemyari, S. S. (2021). Combatting substandard and falsified medicines: Public awareness and identification of counterfeit medications. *Frontiers in Public Health*, 9, 754279. <https://doi.org/10.3389/fpubh.2021.754279>
- Elkalmi, R. M., Al-Worafi, Y. M., Alseragi, W. M., Ming, L. C., & Siddique, A. (2020). Drug safety in Malaysia. In Y. M. Al-Worafi (Ed.), *Drug safety in developing countries: Achievements and challenges* (pp. 245–253). Academic Press. <https://doi.org/10.1016/b978-0-12-819837-7.00021-2>
- Feeney, A. J., Goad, J. A., & Flaherty, G. T. (2024). Global perspective of the risks of falsified and counterfeit medicines: A critical review of the literature. *Travel Medicine and Infectious Disease*, 61, 102758. <https://doi.org/10.1016/j.tmaid.2024.102758>
- Godiyal, M., & Mishra, A. (2025). Impact of digital marketing in consumer purchasing behaviour. *International Journal for Multidisciplinary Research*, 7(2), 1-16. <https://doi.org/10.36948/ijfmr.2025.v07i02.40554>
- Hertig, J. B., & Kennedy, T. M. (2023). Pharmacy student perceptions and knowledge of online pharmacy use. *American Journal of Pharmaceutical Education*, 87(2), ajpe8933. <https://doi.org/10.5688/ajpe8933>
- Karungamye, P. (2023). Counterfeit and substandard drugs in Tanzania: A review. *Forensic Science International: Reports*, 7, 100302. <https://doi.org/10.1016/j.fsir.2022.100302>
- Mohd Nawi, H., Arifin, M. A., Hassan, M. R., Mohammed Nawi, A., Idris, I., & Ghazi, H. F. (2020). Knowledge, attitude and practice of unregistered medicines among patients with chronic disease at urban health clinic, Kelantan, Malaysia. *Global Journal of Public Health Medicine*, 2(2), 235–248. <https://doi.org/10.37557/gjphm.v2i2.67>
- Ocicka, B. (2021). How a digital platform transforms the value proposition in purchasing and buyer-supplier relationship management. *European Research Studies Journal*, 24(4), 44–56. <https://doi.org/10.35808/ersj/2561>
- Ong, S. C., Vasan Thakumar, A., Ooi, G. S., Shafie, A. A., & Ahmad Hassali, M. A. (2020). Perspectives of the public on the consumption of unregistered health products in Malaysia. *International Journal of Pharmacy Practice*, 28(6), 579–590. <https://doi.org/10.1111/ijpp.12673>
- Padma, A., & Ramaiah, M. (2024). Blockchain based solution for secure information sharing in pharma supply chain management. *Heliyon*, 10(22), e40273. <https://doi.org/10.1016/j.heliyon.2024.e40273>
- Pathak, R., Gaur, V., Sankrityayan, H., & Gogtay, J. (2023). Tackling counterfeit drugs: The challenges and possibilities. *Pharmaceutical Medicine*, 37(4), 281–290. <https://doi.org/10.1007/s40290-023-00468-w>
- Suzanna, G. P., Dongre, P., Nimmagadda, A., & Polshettiwar, S. A. (2021). Leveraging consumer's knowledge, attitude, and practices in the management of drug counterfeiting. *Annals of the Romanian Society for Cell Biology*, 25(6), 17297–17312.
- Popoola, O. O., Madhur, G., Mehrim, M. M., Omondi, M. O., Owusu-Mensah, P., Mamtani, S. A., et al.

- (2022). A literature review on the global burden and impact of substandard and falsified medicine. *Annals of Public Health Issues*, 2(1), 16–31. <https://doi.org/10.2478/aphi-2022-0003>
- Por, C. S., Keshavarzi, F., Yap, C. S., & Soh, Y. C. (2020). Knowledge, attitude and practice of general public towards counterfeit and adulterated medicines: A cross-sectional study in Malaysia. *Current Trends in Biotechnology and Pharmacy*, 14(5), 82–91. <https://doi.org/10.5530/ctbp.2020.4s.9>
- Siraj, J., Gebre, A., Shafi, M., Birhan, A., Ejeta, F., & Hambisa, S. (2022). Health care providers' knowledge, attitude and practice toward counterfeit medicines in Mizan-Tepi University Teaching Hospital, South West Ethiopia: A cross-sectional study. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, 59, 1-9. <https://doi.org/10.1177/00469580221108335>
- Wagiealla, W. W., Shantier, S. W., & Gadkariem, E. A. (2022). Public's awareness and attitude towards counterfeit medicines in Sudan: A cross-sectional study. *Journal of Applied Pharmaceutical Science*, 12(6), 115–121. <https://doi.org/10.7324/JAPS.2022.120610>
- Worku, M. C., Mitku, M. L., Ayenew, W., Limenh, L. W., Ergena, A. E., Geremew, D. T., et al. (2024). Assessment of knowledge, attitude, and practice on substandard and counterfeit pharmaceutical products among pharmacy professionals in Gondar City, North-West Ethiopia. *Currents in Pharmacy Teaching and Learning*, 16(10), 102140. <https://doi.org/10.1016/j.cptl.2024.102140>



© 2026 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY-SA) license (<http://creativecommons.org/licenses/by/4.0/>).