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# PATIENT KNOWLEDGE, PERCEPTIONS, AND ACCEPTANCE OF NATIONALLY MANUFACTURED GENERIC ORAL ANTINEOPLASTIC AGENTS IN IRAQ: A PROSPECTIVE CROSS-SECTIONAL SURVEY AT BAGHDAD MEDICAL CITY TEACHING HOSPITALS

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## ABSTRACT

**Background and Aim**: Domestically manufactured generic oral antineoplastic agents are increasingly dispensed through Iraq's public hospital pharmacies, yet no patient-level evidence exists on knowledge, perceptions, or acceptance. This study assessed these among cancer patients at Baghdad Medical City teaching hospitals and identified predictors of favourable perception.

**Methodology**: A prospective, descriptive, cross-sectional survey (August–December 2025) enrolled 152 adult cancer patients receiving nationally manufactured generic oral antineoplastic agents by consecutive sampling. A structured 32-item Arabic questionnaire assessed sociodemographic characteristics, knowledge (scored 0–4), treatment experience, and perception (15-item Likert scale, scored 15–75). Analyses used chi-square ($\chi^2$), Kruskal–Wallis, Spearman correlation, logistic regression, and receiver operating characteristic (ROC) analysis.

**Results**: The mean composite perception score was 42.18 ± 5.68. Perception was Positive in 31.6% (n = 48), Neutral in 32.9% (n = 50), and Negative in 35.5% (n = 54). Educational attainment was the only significant demographic predictor ($\chi^2$ test, p = 0.032), with university-educated patients overrepresented in the Negative group (46.3%). Knowledge and perception scores correlated negatively (Spearman coefficient, ρ = −0.185, p = 0.022). Perception did not differ across disease types (Kruskal–Wallis H = 0.230, p = 0.973). Logistic regression yielded an area under the curve (AUC) of 0.673, with knowledge score the strongest predictor (odds ratio [OR] = 0.773).

**Conclusion**: Iraqi cancer patients hold moderate and heterogeneous perceptions of domestically manufactured generic antineoplastic agents. Higher education paradoxically predicts more negative perception, underscoring the need for transparent quality-assurance communication, pharmacist-led counselling, and oncologist endorsement as the primary drivers of acceptance.

**Keywords:** Oncology; Educational Attainment; Pharmacist-Led Counselling; Oncologist Recommendation; Quality Assurance; Medication Adherence

## 1 INTRODUCTION

Promoting generic medicines is a widely used cost-containment strategy. [1] The World Health Organization (WHO) defines a generic medicine as a product, usually interchangeable with an innovator product, marketed after patent expiry [2], that must demonstrate bioequivalence to the reference product. [1,3] Generics are 20–80% cheaper than originators and account for over half of prescriptions in high-income countries [4,5], and are fundamental to access to essential treatments in low- and middle-income countries (LMICs), including the Middle East and North Africa (MENA) region. [6,8]

Patient uptake nevertheless remains inconsistent, shaped by knowledge, attitudes, and perceptions [1,4], including beliefs that generics are inferior or less effective. [3,5,7] Only about one-third of Saudi participants held a positive perception [2], and surveys in Lebanon, Greece, and Iran report persistent distrust of generic quality, with healthcare professional influence the main determinant of acceptance. [3,5,6,7] Barriers in MENA include physician knowledge gaps [8]; in LMICs, generic-name prescribing without robust bioequivalence frameworks risks undermining substitution [9], and Lebanese pharmacists report quality concerns. [15]

Cancer incidence in Iraq has risen considerably (breast cancer from 36.61 to 61.89 per 100,000 between 2012 and 2022; bladder cancer burden 3.0 times the global average) [11,12,13], while domestically manufactured generic oral antineoplastic agents have progressively replaced imports in the public hospital supply chain. [10,14] Interchangeability evidence is conflicting, as for generic imatinib in chronic myeloid leukaemia (CML) [10,11], and perceptions determine oral anticancer treatment continuation [11]; yet Iraqi evidence is limited to physicians' negative perceptions of national generics [16].

This study therefore assessed the knowledge, perceptions, and acceptance of nationally manufactured generic oral antineoplastic agents among cancer patients at public teaching hospitals in Baghdad, to inform patient education, clinical practice, and policy. [5,7,8,11]

## 2 METHODOLOGY

### 2.1 Study Design and Setting

This prospective, descriptive, cross-sectional survey followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. Data were collected from August to December 2025 at the Oncology and Hematology Teaching Hospitals within the Baghdad Medical City Complex, Baghdad, Iraq, the principal public-sector oncology referral centres in the capital.

### 2.2 Study Population

Eligible patients were adults with a haematological or solid malignancy receiving at least one locally manufactured generic oral antineoplastic agent (lenalidomide, ruxolitinib, ibrutinib, or palbociclib) dispensed by the hospital pharmacy.

### 2.3 Eligibility Criteria

#### 2.3.1 Inclusion Criteria

- Adults (≥18 years) with a confirmed haematological or solid tumour malignancy.
- Currently receiving at least one nationally manufactured generic oral antineoplastic agent dispensed through the hospital pharmacy.
- Able to communicate in Arabic and provided written informed consent.

#### 2.3.2 Exclusion Criteria

- Intravenous chemotherapy or targeted biological infusions only.

- Cognitive impairment, severe psychiatric illness, or any condition preventing participation.
- Incomplete questionnaire (>20% of items unanswered).

### 2.4 Sample Size Calculation

Sample size was calculated using Cochran's formula:

$$n = (Z^2 \times P \times [1 - P]) / d^2$$

where Z = 1.96, P = 0.50 (the most conservative expected proportion, as no Iraqi data exist), and d = 0.08.

Thus n ≈ 150.1; with a 2% contingency, the target was 153. A final sample of 152 completed questionnaires was achieved, closely approximating this target.

### 2.5 Sampling Strategy and Participant Recruitment

Consecutive sampling was used: eligible patients attending the clinics or pharmacy units were approached sequentially until the target was reached. Trained clinical pharmacists obtained written informed consent privately and administered the questionnaire face-to-face in Arabic (15–20 minutes).

### 2.6 Questionnaire Development and Data Collection Tool

The structured questionnaire was developed from validated tools used in comparable MENA and LMIC surveys, translated into Arabic by a bilingual clinical pharmacist, and back-translated independently. It comprised five domains (32 items):

- Section A – Sociodemographic and clinical characteristics (10 items).
- Section B – Knowledge of generic medicines (4 items): definition, equivalence, bioequivalence, and pricing.
- Section C – Experience with generics (3 items): prior exposure and switching between generic and brand-name medicines.
- Section D – Perception of nationally manufactured generic oral antineoplastic agents (15 items): five-point Likert scale (1 = strongly disagree to 5 = strongly agree) covering efficacy, safety, quality, packaging, country of origin, trust in the prescriber, and willingness to continue.
- Section E – Overall satisfaction and treatment preference (2 items).

Content validity was established by five experts and face validity by a pilot study of 15 excluded patients; internal consistency of the 15-item perception scale was assessed with Cronbach's alpha ($\alpha \geq 0.70$ acceptable).

### 2.7 Study Variables

The primary outcome was the composite perception score (sum of the 15 Section D items), categorised as negative (15–34), neutral (35–54), or positive (55–75) by tertile distribution; overall acceptance was a secondary outcome (single direct-preference item). Independent variables were sociodemographic and clinical characteristics (Section A), knowledge score (Section B, 0–4), and prior experience with generics (Section C).

### 2.8 Potential Sources of Bias and Quality Control

Consistent with STROBE, selection bias was minimised by consecutive sampling; social desirability bias by ensuring anonymity and private interviews away from clinical staff; and information bias by structured, pre-coded questions, exclusion of questionnaires with >20% missing items, and double data entry.

### 2.9 Ethical Considerations

The protocol was approved by the Institutional Review Board (IRB) of Baghdad Medical City Complex in accordance with the Declaration of Helsinki. Participants gave written informed consent and were told that participation was voluntary and confidential; no identifying information was retained.

### 2.10 Statistical Analysis

Analyses used the IBM Statistical Package for the Social Sciences (SPSS®), version 26.0 (IBM Corp., Armonk, NY, USA). Data are presented as frequencies (valid percentages), mean ± standard deviation (SD), or median with interquartile range (IQR), according to normality (Shapiro–Wilk test).

Categorical variables were compared using the chi-square ($\chi^2$) or Fisher's exact test, continuous variables using the t-test, Mann–Whitney U test, one-way analysis of variance (ANOVA), or Kruskal–Wallis test, and knowledge–perception

association using Pearson's or Spearman's correlation. Binary logistic regression (positive vs. neutral/negative perception) included variables significant at $p < 0.05$ in bivariate analysis, reporting adjusted odds ratios (aOR) with 95% confidence intervals (CI).

## 3 RESULTS

### 3.1 Sample Overview and Recruitment

A total of 152 patients were enrolled (target 153; response rate 100%). Most were female (n = 94, 61.8%), with a median age in the 50–59-year stratum (36.8%). Multiple myeloma (MM) was the most prevalent diagnosis (36.2%), followed by CML (22.4%), metastatic breast cancer (MBC; 21.1%), and chronic lymphocytic leukaemia (CLL; 13.2%); 54.6% reported comorbidity and 41.4% a monthly household income below 500,000 Iraqi dinars (IQD).

### 3.2 Demographic Characteristics Stratified by Perception Category

Composite perception scores (range 15–75) were calculated after reversing five negatively worded items (coded P3, P4, P8, P11, and P12). The mean score was 42.18 ± 5.68 (median 42, IQR 39–46); data-driven tercile thresholds (≤40, 41–44, >44) gave Negative (n = 54; 35.5%), Neutral (n = 50; 32.9%), and Positive (n = 48; 31.6%) groups.

**Table 1: Demographic characteristics of the cohort by perception category, with chi-square or Kruskal–Wallis p-values.**

| Variable | Category | Total (n=152) | Positive (n=48) | Neutral (n=50) | Negative (n=54) | p-value |
|---|---|---|---|---|---|---|
| Sex | Female | 94 (61.8%) | 33 (68.8%) | 29 (58.0%) | 32 (59.3%) | 0.488 |
| | Male | 58 (38.2%) | 15 (31.2%) | 21 (42.0%) | 22 (40.7%) | |
| Age group | 30–39 | 6 (3.9%) | 2 (4.2%) | 2 (4.0%) | 2 (3.7%) | 0.987 |
| | 40–49 | 26 (17.1%) | 8 (16.7%) | 7 (14.0%) | 11 (20.4%) | |
| | 50–59 | 56 (36.8%) | 18 (37.5%) | 18 (36.0%) | 20 (37.0%) | |
| | ≥60 | 64 (42.1%) | 20 (41.7%) | 23 (46.0%) | 21 (38.9%) | |
| Education | Primary/None | 68 (44.7%) | 25 (52.1%) | 21 (42.0%) | 22 (40.7%) | 0.032 |
| | Middle School | 14 (9.2%) | 7 (14.6%) | 5 (10.0%) | 2 (3.7%) | |
| | High School | 21 (13.8%) | 9 (18.8%) | 7 (14.0%) | 5 (9.3%) | |
| | University+ | 49 (32.2%) | 7 (14.6%) | 17 (34.0%) | 25 (46.3%) | |
| Monthly income | <500k IQD | 63 (41.4%) | 23 (47.9%) | 19 (38.0%) | 21 (38.9%) | 0.556 |
| | 500k–1M IQD | 57 (37.5%) | 15 (31.2%) | 18 (36.0%) | 24 (44.4%) | |
| | >1M IQD | 32 (21.1%) | 10 (20.8%) | 13 (26.0%) | 9 (16.7%) | |
| Disease type | Multiple Myeloma | 55 (36.2%) | 15 (31.2%) | 19 (38.0%) | 21 (38.9%) | 0.136 |
| | CML | 34 (22.4%) | 8 (16.7%) | 13 (26.0%) | 13 (24.1%) | |
| | Met. Breast Cancer | 32 (21.1%) | 14 (29.2%) | 5 (10.0%) | 13 (24.1%) | |
| | CLL | 20 (13.2%) | 6 (12.5%) | 7 (14.0%) | 7 (13.0%) | |
| | Other | 11 (7.2%) | 5 (10.4%) | 6 (12.0%) | 0 (0.0%) | |
| Comorbidity | Yes | 83 (54.6%) | 28 (58.3%) | 27 (54.0%) | 28 (51.9%) | 0.802 |
| | No | 69 (45.4%) | 20 (41.7%) | 23 (46.0%) | 26 (48.1%) | |
| Knowledge score (0–4) | Mean ± SD | 1.62 ± 1.33 | 1.38 ± 1.39 | 1.60 ± 1.32 | 1.85 ± 1.27 | 0.285 |

Educational attainment was the only significant difference across perception categories ($\chi^2$ test, $p = 0.032$; Table 1): university-educated patients were overrepresented in the Negative group (46.3%) versus the Neutral (34.0%) and Positive (14.6%) groups. Sex, age, income, disease type, and comorbidity did not differ (all $p > 0.05$). Knowledge score

did not differ across categories (Kruskal–Wallis H = 2.51, p = 0.285), though it was numerically higher in the Negative (1.85) than the Positive (1.38) group.

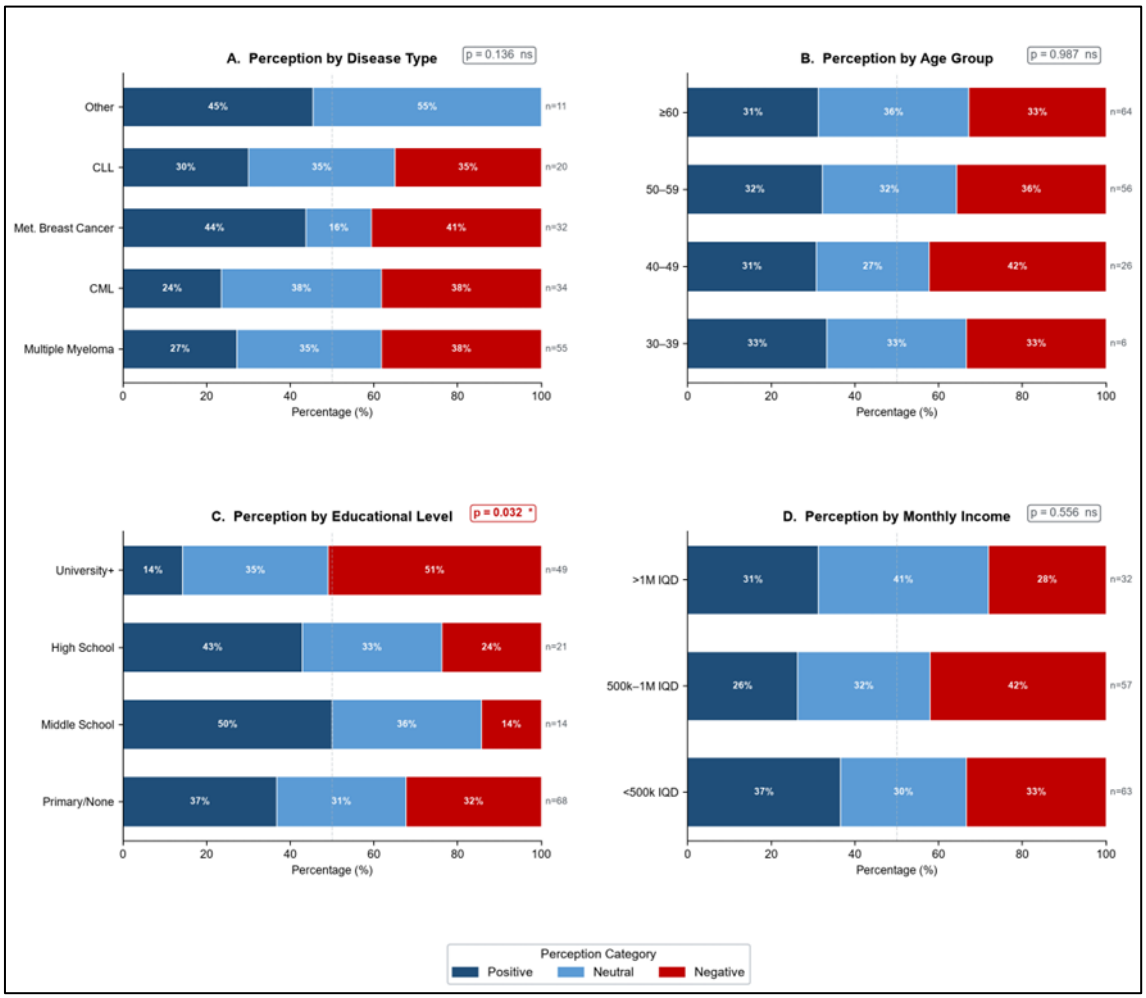



**Figure 1: Demographic profile of the cohort (n = 152) by perception category (100% stacked bars; chi-square p-values annotated). Only educational attainment was significant (p = 0.032).**

### 3.3 Knowledge and Experience Outcomes Across Perception Groups

Knowledge was assessed with four true/false items (K1–K4; score 0–4) and experience with three yes/no items (E1–E3). Mean knowledge was 1.62 ± 1.33 out of 4 (K1–K3 answered correctly by 46.1%, 56.6%, and 59.2%); 32.2% reported prior generic antineoplastic use (E1) and 34.2% a switch from reference to generic (E3). No item differed across perception categories (all p > 0.05; Table 2, Figure 2).

**Table 2: Knowledge and experience item responses across the cohort and by perception subgroup.**

| Domain | Item | Yes (n) | Yes (%) | No (n) | No (%) |
|---|---|---|---|---|---|
| Knowledge | Knows definition of generic medicines | 70 | 46.1 | 82 | 53.9 |
| Knowledge | Knows generics contain same active substance | 86 | 56.6 | 66 | 43.4 |
| Knowledge | Knows generics are lower priced | 90 | 59.2 | 62 | 40.8 |
| Experience | Ever stopped/changed medication due to cost or unavailability | 49 | 32.2 | 103 | 67.8 |
| Experience | Purchased generic medication because of lower price | 81 | 53.3 | 71 | 46.7 |
| Experience | Would choose generic over brand-name medication | 52 | 34.2 | 100 | 65.8 |

| | | | | | |
|---|---|---|---|---|---|
| Knowledge Score | Score = 0 | 55 | 36.2 | | |
| Knowledge Score | Score = 1 | 9 | 5.9 | | |
| Knowledge Score | Score = 2 | 27 | 17.8 | | |
| Knowledge Score | Score = 3 | 61 | 40.1 | | |

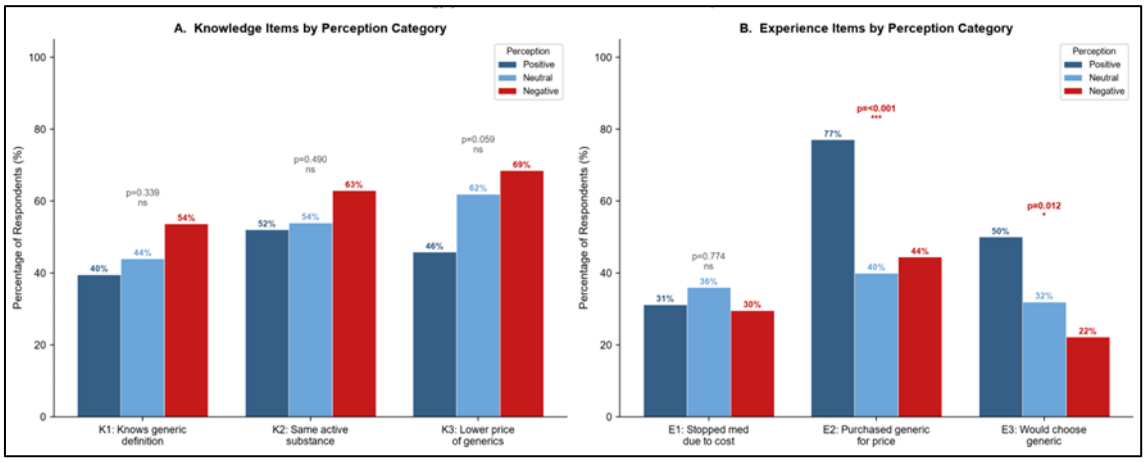



**Figure 2: Proportions of correct knowledge responses (K1–K3) and affirmative experience responses (E1–E3) by perception category; no item was significant (p > 0.05).**

### 3.4 Analysis of Individual Perception Items

Table 3 and Figure 3 present the 15 perception items. Safety trust (P11) scored highest (mean 4.41), followed by physician recommendation (P7; 3.75) and efficacy equivalence to the brand-name medicine (P2; 3.74); items on manufacturing standards, quality assurance, and post-marketing surveillance (P5, P6, P9) scored lowest, with the broadest disagreement.

**Table 3: Mean Likert scores for individual perception items (post-reversal for negatively worded items P3, P4, P8, P11, P12; 1 = most negative, 5 = most positive). SD (%) = strongly disagree, D = disagree, N = neutral, A = agree, SA = strongly agree (% of respondents); SD in the final column = standard deviation.**

| Item | Description | SD (%) | D (%) | N (%) | A (%) | SA (%) | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| P1 | Local generics are as effective as international brand medicines | 3.9 | 13.2 | 21.7 | 36.2 | 25.0 | 3.65 | 1.11 |
| P2 | I trust Iraqi-manufactured medicines to be safe | 2.6 | 15.1 | 15.8 | 38.2 | 28.3 | 3.74 | 1.11 |
| P3 | Local generics have more side effects than brand [R] | 5.3 | 38.2 | 25.0 | 25.0 | 6.6 | 2.89 | 1.05 |
| P4 | Brand medicines are of higher quality than generics [R] | 1.3 | 8.6 | 18.4 | 27.0 | 44.7 | 4.05 | 1.05 |
| P5 | Packaging and appearance affect my trust in a medicine | 5.3 | 25.0 | 19.7 | 25.0 | 25.0 | 3.39 | 1.25 |
| P6 | Cost is a major factor when choosing medications | 0.7 | 8.6 | 13.8 | 38.2 | 38.8 | 4.06 | 0.96 |
| P7 | I would accept a generic if it significantly reduces cost | 4.6 | 15.8 | 15.1 | 28.9 | 35.5 | 3.75 | 1.22 |
| P8 | If doctor prescribes brand, I would not accept generic sub [R] | 7.2 | 17.1 | 12.5 | 27.6 | 35.5 | 3.67 | 1.31 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| P9 | Doctor should always prescribe generic if available | 3.9 | 11.8 | 16.4 | 34.9 | 32.9 | 3.81 | 1.14 |
| P10 | Greater knowledge about generics will increase their use | 0.7 | 5.3 | 22.4 | 44.7 | 27.0 | 3.92 | 0.87 |
| P11 | I prefer brand-name medicines for anticancer drugs [R] | 1.3 | 3.3 | 9.2 | 25.0 | 61.2 | 4.41 | 0.89 |
| P12 | I worry about counterfeit or low-quality local medicines [R] | 7.2 | 16.4 | 9.9 | 26.3 | 40.1 | 3.76 | 1.33 |
| P13 | I prefer to receive medicines from hospital pharmacy | 0.7 | 2.0 | 3.9 | 19.7 | 73.7 | 4.64 | 0.71 |

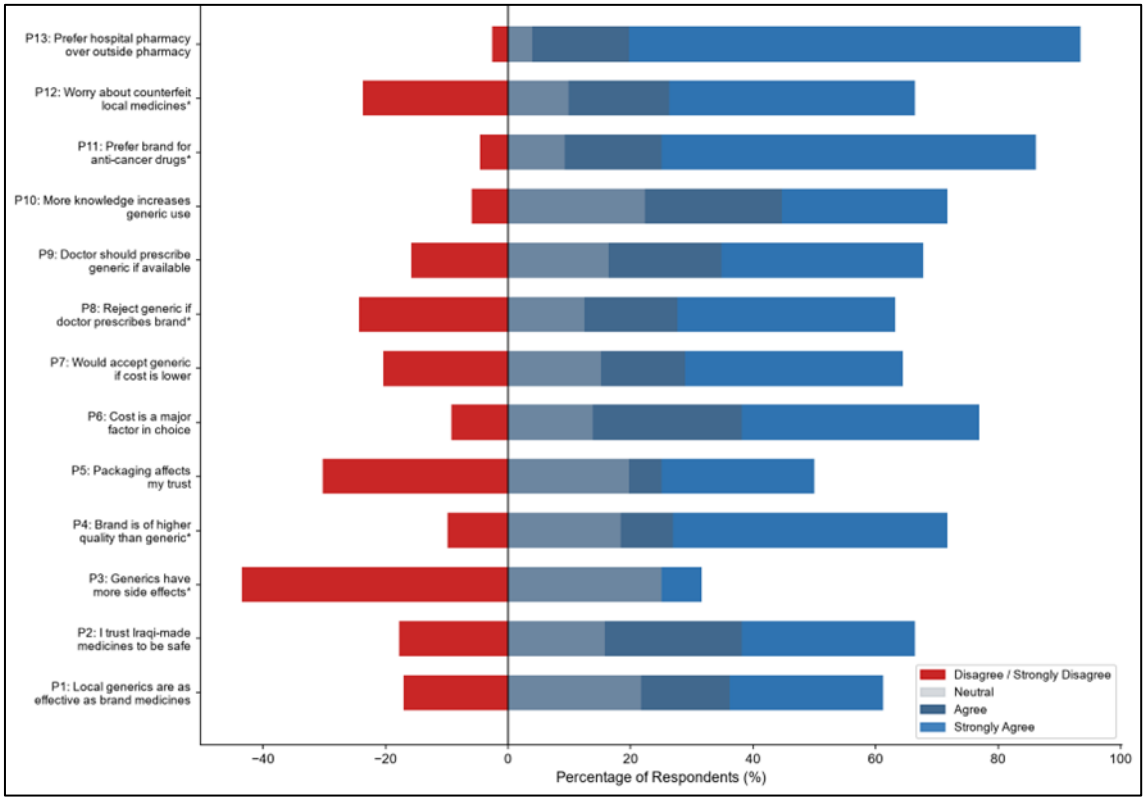



**Figure 3: Diverging stacked bar chart of perception item responses (n = 152), centred at 'Neutral'; negatively worded items (P3, P4, P8, P11, P12) were score-reversed so all bars represent the positive-perception direction.**

### 3.5 Perception Scores by Disease Type: Pairwise Comparisons with Correction

Perception did not differ across disease groups (Kruskal–Wallis H = 0.230, p = 0.9727; Figure 4), and Bonferroni-corrected pairwise Mann–Whitney U tests showed no significant differences (all corrected p > 0.05).

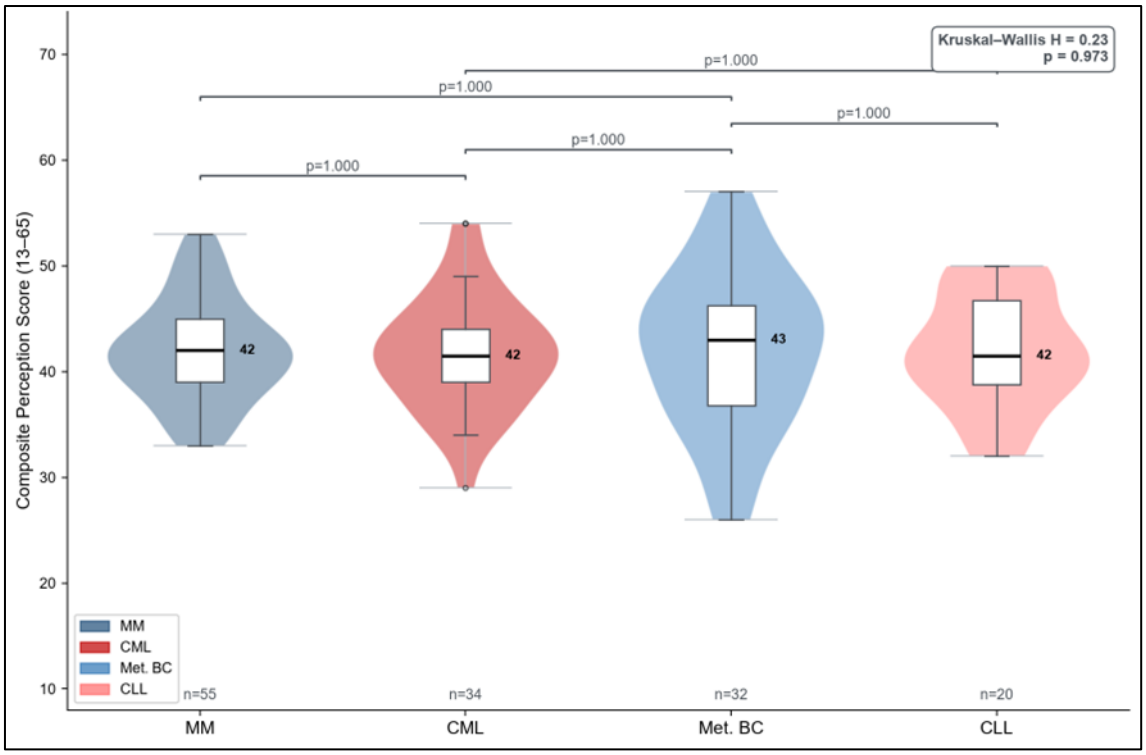



**Figure 4: Violin and box plots of composite perception scores by disease type (n = 152); lines denote medians, boxes the IQR, whiskers 1.5 × IQR. Bonferroni-corrected Mann–Whitney U p-values are shown above the violins (ns = not significant).**

### 3.6 Treatment Satisfaction and Medication Preference

Most patients reported moderate-to-high treatment satisfaction (Likert 1–5), which did not differ across disease groups (Kruskal–Wallis H = 0.230, p = 0.9727).

### 3.7 Knowledge–Perception Correlation

Spearman correlation between knowledge score (0–4) and composite perception score yielded a small but significant negative coefficient (ρ = −0.185, p = 0.0223): patients with higher knowledge tended to hold less favourable perceptions.

### 3.8 Predictive Modelling: Binary Logistic Regression and Receiver Operating Characteristic (ROC) Analysis

Logistic regression for above- versus at/below-median perception (median 42), with knowledge score, educational level, monthly income, and sex as covariates (continuous predictors z-standardised), was significant overall (Table 4).

**Table 4: Binary logistic regression model for above-median composite perception score (n = 152). Predictors were standardised (z-score). OR = odds ratio; CI = confidence interval.**

| Variable | β | OR | 95% CI | p-value | Significance |
|---|---|---|---|---|---|
| Sex (female) | 0.637 | 1.890 | 0.915–3.905 | 0.086 | ns |
| Age group (ordinal) | 0.085 | 1.089 | 0.715–1.658 | 0.691 | ns |
| Education level (ordinal) | -0.122 | 0.885 | 0.661–1.184 | 0.411 | ns |
| Monthly income (ordinal) | 0.348 | 1.417 | 0.857–2.344 | 0.175 | ns |
| Presence of comorbidity | -0.634 | 0.530 | 0.248–1.134 | 0.102 | ns |
| Disease type (ordinal) | 0.206 | 1.228 | 0.932–1.619 | 0.144 | ns |
| Duration since diagnosis | 0.356 | 1.428 | 0.916–2.228 | 0.116 | ns |
| Knowledge score (0–4) | -0.257 | 0.773 | 0.592–1.009 | 0.058 | ns |

Knowledge score showed the strongest association (odds ratio [OR] = 0.773; p = 0.058), sex approached significance (OR = 1.890; p = 0.086), and education (OR = 0.885; p = 0.411) and income (OR = 1.417; p = 0.175) were not independently significant.

Receiver operating characteristic analysis (Figure 5) gave an area under the curve (AUC) of 0.673 (95% CI by the DeLong method in the figure), indicating moderate discrimination; the Youden's J threshold yielded a sensitivity of 52.2% and specificity of 77.1%.

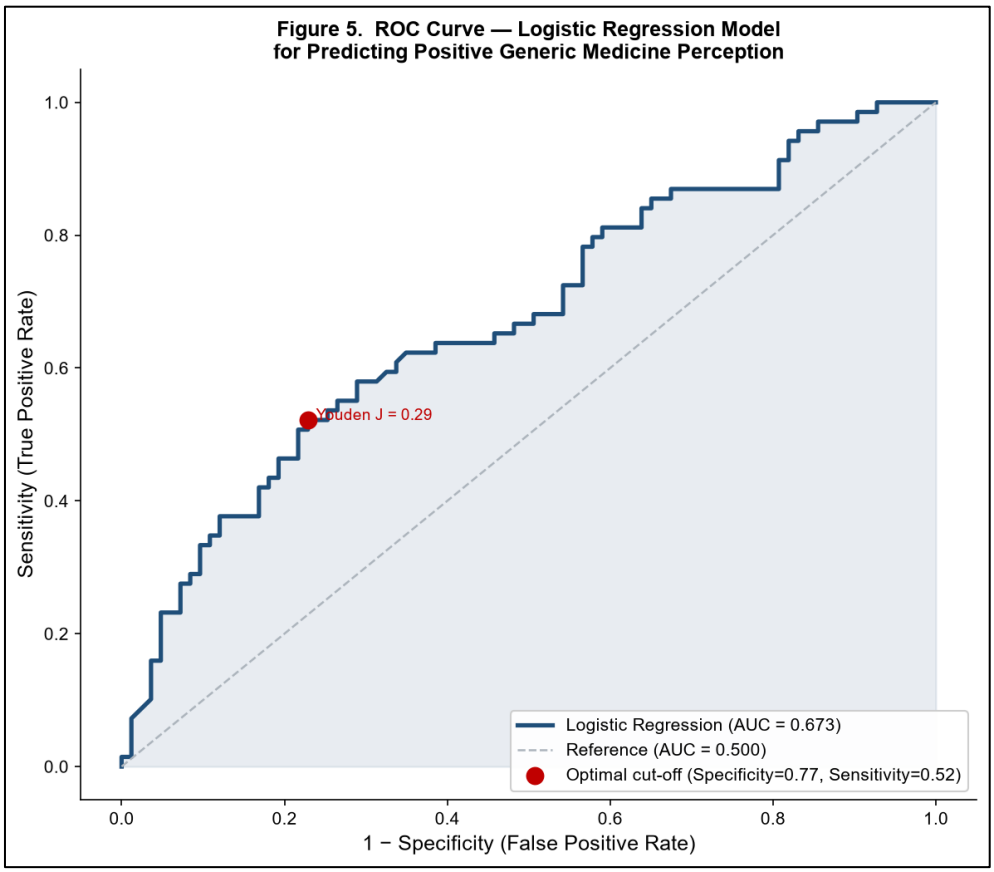



**Figure 5: Receiver operating characteristic (ROC) curve for the binary logistic regression model predicting above-median composite perception score (n = 152). AUC = 0.673. The optimal operating point (Youden's J) is marked; sensitivity = 52.2%, specificity = 77.1%.**

### 3.9 Summary of Key Findings

Perception was moderate (mean 42.2/75); education was the only significant demographic correlate (p = 0.032), knowledge correlated negatively with perception (ρ = −0.185, p = 0.0223), and disease type had no effect.

## 4 DISCUSSION

### 4.1 Overview

This first Iraqi study found moderate perception (mean 42.18 ± 5.68 out of 75), inversely associated with education and weakly with knowledge (ρ = −0.185, p = 0.022), unrelated to disease type, and modestly predicted by knowledge (AUC = 0.673).

### 4.2 Overall Level of Patient Perception: Alignment and Divergence with Global Evidence

The distribution of perception (31.6% Positive, 32.9% Neutral, 35.5% Negative) parallels MENA and LMIC surveys: only about one-third of Saudi consumers were favourable [2], suggesting systemic rather than setting-specific barriers [2,7], and Lebanese misconceptions were attributed to inadequate education and physician communication [3], echoing our high physician-recommendation score (P7). Indian studies report more negative perceptions at a tertiary hospital [18] and low generic knowledge among pharmacy clients [31], and only about two-thirds of Chinese physicians and pharmacists agreed that approved generics are as effective as brand-name products. [17]

### 4.3 Educational Attainment and the Inverse Perception Gradient

Educational attainment showed an inverse gradient with perception ($p = 0.032$), contrary to studies linking education to knowledge and acceptance. [1,7,24] The paradox may reflect heightened awareness of limitations in domestic manufacturing, including good manufacturing practice (GMP) compliance, pharmacovigilance, and bioequivalence testing rigour [26]; such concerns may exceed actual quality risk [32], so education must be paired with transparent quality-assurance messaging, including local bioequivalence data and GMP certification status. [8,19,32]

### 4.4 The Knowledge–Perception Paradox

Greater knowledge was associated with less favourable perception, diverging from surveys in which knowledge predicted acceptance [1,3,17], although familiarity did not yield unconditional acceptance in Iran [6] or among biosimilar users with multiple sclerosis [22], and students with greater academic exposure held more nuanced but not more accepting views. [30] In oncology, beliefs about medication quality and source drive adherence [9,28]; knowledgeable Iraqi patients may also know of concerns about local bioequivalence testing documented among Iraqi physicians [16], so knowledge is necessary but not sufficient without evidence of regulatory compliance. [11]

### 4.5 Physician Influence and Safety Trust as Key Perception Drivers

Physician recommendation (P7) and safety trust (P11) were the highest-rated constructs, in line with Kassandros et al. [5] and Alqawasmeh et al. [7], who found provider endorsement and physician and pharmacist counselling the strongest facilitators of acceptance, although physicians may not address informed patients' quality concerns. [23] Saudi pharmacists saw physician approval as a prerequisite for substitution [20], and a pharmacist-led programme in Japan improved knowledge and perception and increased switching, with age ≥65 years the strongest barrier (OR = 16.45) [25], implying that older Iraqi patients need more intensive counselling.

### 4.6 Disease-Type Independence of Perception

Perception did not differ across disease groups ($H = 0.230$, $p = 0.973$), consistent with systemic drivers (trust in the manufacturing source, physician guidance, quality assurance) rather than disease-specific factors. [27]

Disease-specific concerns exist: van Sabben et al. [21] attributed more adverse events after switching to generic imatinib to a nocebo effect that residual quality doubts could amplify in Iraq, and outcomes in CML are conflicting [10]; adherence in Palestinian breast cancer patients depended on satisfaction. [28]

### 4.7 Predictive Modelling and Clinical Utility of the Logistic Regression Model

Knowledge score was the strongest, though marginally non-significant, predictor of above-median perception (OR = 0.773, $p = 0.058$). The AUC of 0.673 indicates moderate discrimination, adequate for identifying negative-perception patients (specificity 77.1%) but not for screening; sex effects (OR = 1.890; $p = 0.086$) may be context-dependent [2,6,24], and unmeasured predictors such as health literacy may improve future models. [5,29]

### 4.8 Implications for Clinical Practice and Pharmaceutical Policy in Iraq

Moderate-to-negative perception in about two-thirds of patients despite available clinical pharmacists shows that passive exposure does not yield acceptance [31]. Structured pharmacist counselling [25] should become standard at Baghdad Medical City and other public oncology centres; educated patients need primary data on GMP certification, bioequivalence, and pharmacovigilance [32], as advocated for LMIC regulation [8,19], with the National Centre for Drug Control and Research (NCDCR) publishing bioequivalence dossiers [11]; and oncologists, whose recommendation shapes adherence through trust [27], need continuing medical education on generic interchangeability. [10,11,21]

### 4.9 Study Limitations

Limitations include the cross-sectional design (no causal inference); recruitment at two tertiary Baghdad hospitals, limiting generalisability; self-reported data with possible social desirability bias; an adapted perception scale lacking formal Arabic-language psychometric validation; a coarse four-item knowledge subscale; and no adherence or clinical outcome data.

## *Recommendations*

The findings and limitations point to four priorities for Iraqi oncology care.

- Pharmacist-led counselling. Incorporate structured pre-treatment counselling by clinical pharmacists into standard oncology practice. [25,31]

- Transparent quality assurance. The NCDCR should publish bioequivalence dossiers and post-marketing surveillance outcomes for domestically manufactured antineoplastic agents. [8,11,19,32]
- Oncologist engagement. Continuing medical education should address the regulatory basis and clinical evidence for generic interchangeability. [10,11,21]
- Future research. Studies should include district-level and private-sector centres, use validated Arabic-language instruments, and link perception longitudinally to adherence and treatment response.

## 5 CONCLUSION

This study provides the first patient-level evidence on the knowledge, perceptions, and acceptance of nationally manufactured generic oral antineoplastic agents among Iraqi cancer patients. Perception was moderate, with only about one-third fully favourable. Education was the only demographic factor associated with perception ($p = 0.032$), and knowledge correlated negatively with perception ($\rho = -0.185$, $p = 0.022$), likely reflecting awareness of domestic quality limitations rather than rejection of bioequivalence. Physician recommendation was the highest-rated driver, disease type did not predict perception, and the logistic model showed moderate discrimination (AUC = 0.673). Pharmacist-led counselling, transparent quality-assurance reporting, and oncologist education are the priorities for acceptance.

## STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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### *Disclosure of conflict of interest*

The authors declare that there are no conflicts of interest regarding the publication of this article.

### *Statement of ethical approval*

The protocol was approved by the Institutional Review Board (IRB) of Baghdad Medical City Complex in accordance with the Declaration of Helsinki. Participants gave written informed consent and were told that participation was voluntary and confidential; no identifying information was retained.

### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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