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Comprehensibility of pharmaceutical pictograms in patient information leaflets: A cross-sectional study in Ankara, Türkiye

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ABSTRACT

This study aimed to assess the comprehensibility of commonly used pharmaceutical pictograms in Türkiye and examine how socio-demographic characteristics, health literacy, and medication-related behaviors influence pictogram interpretation. This cross-sectional descriptive study was conducted among 626 adults residing in Ankara, Türkiye, using an online survey. The survey included socio-demographic questions, a Single-Item Health Literacy Screening (SILS), a Medication Adherence Scale (MMAS-4), and a Pictogram Comprehension Test covering 12 pharmaceutical pictograms. Guessability scores and guessability performance were calculated to measure pictogram comprehensibility. The average guessability performance score was 19.48 ± 14.83, indicating a low overall comprehension level. Among the 12 pictograms, only one (P5, 76.3%) met the ISO 9186-1 comprehension criterion of 67%, while P7 had the highest incorrect response rate (94.9%). Age, gender, occupation, income, chronic illness status, health literacy, awareness of medication side effects, and medication instruction reading habits were found to significantly influence pictogram comprehension ($p<0.05$). The findings suggest that pharmaceutical pictograms in Türkiye may not be sufficiently effective as standalone communication tools, as their comprehensibility is influenced by multiple socio-demographic and behavioral factors. To improve their effectiveness, pictograms should be redesigned based on

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user feedback, standardized in accordance with ISO guidelines, and supplemented with educational interventions.

Keywords: pharmaceutical pictograms, health literacy, medication adherence, patient information leaflets, Türkiye

INTRODUCTION

In today's world, rapid access to information has become one of the most crucial factors in enhancing individuals' quality of life. The concise, clear, and effective transmission of information is particularly significant for ensuring that complex and technical content is comprehensible to a broad audience. In this context, visual communication tools such as symbols, icons, and pictograms serve as fundamental means of facilitating meaning transfer among individuals. The impact of visual elements extends beyond everyday communication and plays a critical role in fields such as health communication. In healthcare services, the role of visual tools in enabling patients to access and comprehend accurate information is increasingly recognized and acknowledged.

Studies have shown that approximately 80% of information conveyed through verbal communication is forgotten within a short period[1,2]. In contrast, visual memory is known to be significantly stronger than verbal memory, and information presented through visual means tends to be more enduring. This phenomenon, known as the picture superiority effect, demonstrates that visual tools such as pictograms are more effective in information transmission compared to written texts. By representing an object, concept, or action through symbolic imagery, pictograms facilitate comprehension, particularly for individuals with low literacy levels and communities with language differences[3].

Derived from the Latin roots pictus (painted) and graph (written thing), pictograms have been used as a means of communication by humanity since ancient times. In the modern world, pictograms have a wide range of applications, from traffic signs and chemical safety labels to airport navigation signs and hospital information boards. In the healthcare sector, pictograms found in patient information leaflets play a crucial role in facilitating patients' access to medication-related information. Research indicates that pictograms are not only effective in conveying information but also contribute to enhance patient satisfaction, improve adherence to treatment, and reduce dosage errors[4,5].

The comprehensibility of pictograms can vary depending on the cultural, demographic, and individual characteristics of the target audience[6]. For

instance, while a pictogram may be clearly perceived in one culture, it may not be equally effective in another. Therefore, considering the socio-demographic characteristics of the target population is of great importance in the design and implementation of pictograms[7]. Additionally, it has been noted that the direct involvement of the target group in the evaluation process is another critical factor that enhances the effectiveness of these visual tools[8].

Recent studies conducted between 2022 and 2025 have further emphasized that the effectiveness of pharmaceutical pictograms is not universal; rather, it is highly dependent on health literacy levels and the specific health-seeking behaviors of the population[9,10]. For instance, recent research highlights that while pictograms can bridge communication gaps, their misinterpretation remains a significant risk for medication safety, particularly in systems where standardized visual guidelines are still evolving[10]. Furthermore, as healthcare communication increasingly utilizes diverse visual tools, the role of validated pictograms becomes even more critical in preventing medication errors among different demographic groups[11].

In Türkiye, the information required to be included in the packaging and patient information leaflets of licensed or authorized human medicinal products to ensure their correct use for individuals' health and safety was regulated by Law No. 30048, dated April 25, 2017. According to this regulation, there is no established standard or requirement for the use of pictograms. Although the regulation suggests that evidence may be required to demonstrate that the symbols and pictorial diagrams used are generally understood and not misleading or confusing, there is no mandatory readability test or standardized assessment for patient information leaflets[12].

Despite the global recognition of visual tools in healthcare, a review of the literature reveals a significant gap regarding the Turkish context. In Türkiye, while regulations suggest the use of symbols, the absence of a mandatory standardized assessment or readability test creates a potential risk for patient safety. To date, no comprehensive study has evaluated the public's understanding of these pictograms or identified the specific socio-demographic barriers to their comprehension within the Turkish healthcare landscape. This study addresses this critical gap by being the first to systematically evaluate the most used pharmaceutical pictograms in Türkiye. By examining the relationship between pictogram comprehension, health literacy, and medication adherence, this research provides policymakers with essential evidence to establish national standards for pharmaceutical visual communication.

METHODOLOGY

The study is designed as a cross-sectional descriptive field study. Data collection process was conducted between September 1, 2024 and October 30, 2024.

Population and sample

The population of this study consists of individuals aged 18 to 64 residing in the central districts of Ankara, the capital of Türkiye. The sample size was determined based on the ISO 9186-1 standards for testing graphical symbols, which require a minimum of 50 participants per pictogram. Accordingly, the sample size was calculated as 12 pictograms × 50 participants = 600 participants.

For sample selection, convenience sampling—a non-probability sampling method—was employed to reach a diverse group of participants. To ensure the quality of the sample, specific inclusion criteria were applied: being aged 18 or older, having no cognitive impairments that would prevent understanding the pictograms, and volunteering to participate. The survey link was distributed across various digital platforms and social media networks to increase reach across different socio-demographic backgrounds. A total of 626 individuals completed the survey, exceeding the minimum requirement of the ISO standard and providing a diverse representation of the urban population in Ankara.

Data collection tools

The data were collected through a structured online survey designed by the researchers based on a literature review. The survey consists of five main sections:

1. Socio-Demographic Information: Includes key demographic variables such as participants' age, gender, education level, marital status, occupation, and income level.

2. Health Status: Covers questions regarding participants' general health status, presence of chronic diseases, and medication use habits.

3. Single-Item Health Literacy Screener: Participants' health literacy levels were assessed using the Single-Item Literacy Screener (SILS) developed by Morris, MacLean, Chew, and Littenberg (2006)[13]. The screening consists of a single question: "How often do you need to have someone to help you when you read instructions, pamphlets, or other written material from your doctor or pharmacy?" Responses are recorded on a five-point Likert scale (1 = Never, 5 = Always), with scores above 2 indicating low health literacy[14].

4. Medication Adherence Scale: The study utilized the 4-item Morisky Medication Adherence Scale (MMAS-4), originally developed by Morisky, Green, and Levine (1986)[15] and adapted into Turkish with validated reliability by Yılmaz and Buzlu (2012)[16]. This scale assesses participants' medication adherence behaviors through four yes/no questions. If all responses are "no", adherence is classified as high. If one or two responses are "yes", adherence is moderate. If three or four responses are "yes", adherence is considered low.

5. Pictogram Comprehension Test: In the fifth section of the survey, 12 commonly used pharmaceutical pictograms in different pharmaceutical forms in Türkiye were selected (Appendix 1). For each pictogram, participants were asked an open-ended question: "If you see this image in a patient information leaflet, what do you think it means?"

The responses collected from participants were independently reviewed by three researchers conducting the study. Each response was evaluated to determine whether it matched the intended meaning of the pictograms and was categorized as correct, partially correct, incorrect, or opposite. Inter-rater reliability was assessed using Fleiss' kappa coefficient, which was calculated as 0.876 (95% CI: 0.721–0.987) for the 12 pictograms. According to Fleiss' classification, a Kappa value of 0.75 or higher is considered an excellent agreement category. Following the initial independent assessments, the researchers discussed responses that received different ratings, seeking consensus on inconsistent evaluations. If no agreement was reached, the majority rating was accepted as final. To assess pictogram comprehensibility, scores were assigned as follows:

Correct responses: 1 point
Partially correct responses: 0.5 points
Opposite responses: -1 point
Incorrect responses: 0 points
Two different scores were calculated for analysis:

Guessability Score: Represents the percentage of correct responses for each pictogram (e.g., "Pictogram I was correctly understood by x% of participants"). Each pictogram's guessability score was assessed based on the ISO standard comprehension criterion of 67% while ensuring that opposite responses did not exceed 5%.

Guessability Performance: Represents the overall accuracy percentage of an individual participant in the pictogram comprehension task (e.g., "Participant Y successfully understood an average of z% of the pictograms").

Data analysis

The collected data were analyzed using IBM SPSS 27.0 statistical software, employing descriptive statistics and hypothesis tests. The dependent variables of the study were Guessability Score and Guessability Performance, while the independent variables included socio-demographic characteristics, health status, health literacy, medication use, and medication adherence. For categorical variables, frequencies (n) and percentages (%) were calculated, whereas for continuous quantitative variables, means (M) and standard deviations (SD) were reported. Guessability Score was assessed using frequencies and percentages, while Guessability Performance was evaluated using means and standard deviations. The Kolmogorov-Smirnov test was conducted to assess the normality of Guessability Performance ($p<0.05$). Since the normality assumption was violated, Mann-Whitney U test was used for binary independent variables, and Kruskal-Wallis test was applied for independent variables with three or more categories. A significance level of 0.05 was used for all hypothesis tests.

RESULTS and DISCUSSION

The distribution of participants according to their socio-demographic characteristics is presented in Table 1. Among the participants, 68.8% were under the age of 30, 66.0% were female, 64.9% were single, and 55.4% had a bachelor's degree. Additionally, 49.7% of the participants were unemployed, while 37.4% had an income exceeding 62.653 TL (Table 1).

Table 1. Distribution of participants according to their socio-demographic characteristics

Variable	Number (n)	Percentage (%)
Age		
<30	430	68.8
≥30	196	31.2
Gender		
Female	413	66.0
Male	213	34.0
Marital Status		
Single	406	64.9
Married	193	30.8
Divorced/Separated/Deceased	27	4.3
Education		
Primary school	13	2.1
Primary/Secondary school	13	2.1
High School/Vocational high school	108	17.3
Associate degree	97	15.5
Bachelor's degree	347	55.4
Master's degree/PhD	48	7.7
Occupation		
Not working	311	49.7
Blue collar	139	22.2
White collar	176	28.1
Income		
≤19.234 TL	87	13.9
19.235 TL-40.944 TL	152	24.3
40.945- 62.652 TL	153	24.4
≥62.653 TL	234	37.4
Total	626	100

Table 2 presents the participants' health-related characteristics. 48.7% of the participants rated their health as good, while 19.0% reported having a chronic illness. 43.9% of the participants had high health literacy. Additionally, 82.6% did not have a prescription medication report, 66.8% were aware of the side effects of their medications, and 96.8% took their medications independently. Furthermore, 23.0% had purchased a non-prescription drug in the last four weeks, 29.4% frequently read medication instructions, and 91.4% found these instructions easy to understand (Table 2).

Table 2. Distribution of participants according to their health status

Variable	Number (n)	Percentage (%)
General Health Status		
Excellent	63	10.1
Very good	167	26.7
Good	305	48.7
Average	84	13.4
Poor	7	1.1
Chronic disease		
No	507	81.0
Yes	119	19.0
Health literacy		
Low	351	56.1
High	275	43.9
Medication report		
No	517	82.6
Yes	109	17.4
Knowledge of side effects		
No	208	33.2
Yes	418	66.8
Person administering medication		
Self	607	97.0
Spouse/Children	5	0.8
People with him/her	14	2.2
Purchasing over the counter medication		
No	482	77.0
Yes	144	23.0
Reading medication instructions		
Never	33	5.3
Rarely	105	16.8
Sometimes	140	22.4
Frequently	184	29.4
Always	164	26.2
Understanding instructions		
No	54	86
Yes	572	91.4
Medication adherence		
Low	125	20.0
Medium	287	45.9
High	214	34.2

Table 3 presents the pictogram guessability scores. The pictogram with the highest percentage of correct responses (76.3% – P5) represents the visual of dry powder for preparing pediatric oral suspension. Conversely, the pictogram with the highest percentage of incorrect responses (94.9% – P7) depicts a vial containing injection solution powder and a prefilled syringe with a diluent.

Table 3. Guessability scores of pictograms

Pictogram	True (%)	Opposite (%)	Validity
P1	54.4	1.4	-
P2	40.3	4	-
P3	35.8	1.0	-
P4	26.5	1.8	
P5	76.3	0.5	Validity
P6	25.2	-	-
P7	5.1	-	-
P8	14.1	-	-
P9	40.5	11.2	-
P10	36.8	0.8	-
P11	17.6	-	-
P12	29.4	-	-

The average guessability performance score for participants was calculated as 19.48 ± 14.83. Participants aged 30 years or older had a higher average score (21.96 ± 15.93) compared to those under 30 years old (18.36 ± 14.18) ($p<0.05$). The average score of female participants (20.73 ± 14.76) was higher than that of male participants (17.02 ± 14.70) ($p<0.05$). A statistically significant difference was observed in pictogram comprehension levels among unemployed (19.52 ± 15.04), blue-collar (16.43 ± 13.47), and white-collar workers (21.85 ± 15.13) ($p<0.05$). A statistically significant difference was found among income groups; participants with an income ≤19.234 TL had a lower average score (15.63 ± 13.78) (Table 4).

Participants with chronic illnesses had a higher average score (23.63 ± 14.93) compared to those without a chronic illness (18.50 ± 14.65). Participants with high health literacy had a higher average score (20.86 ± 15.21) than those with low health literacy (17.74 ± 14.17). Participants who were aware of the side

effects of their medications had a higher average score (21.10 ± 15.41) compared to those who were not aware (16.17 ± 12.99). Participants who frequently read medication instructions before use had a higher average score (20.21 ± 15.46) than those who rarely or never read them (16.87 ± 11.98) ($p<0.05$) (Table 4).

Table 4. Participants' guessing performance according to their socio-demographic characteristics and health status

Variable	n	Mean	SD	p
Age				
<30	430	18.36	14.18	0.004*
≥30	196	21.96	15.93	
Gender				
Female	413	20.73	14.76	0.003*
Male	213	17.02	14.70	
Occupation				
Not working	311	19.52	15.04	0.004*
Blue collar	139	16.43	13.47	
White collar	176	21.85	15.13	
Income				
≤19.234 TL	87	15.63	13.78	0.039*
19.235 TL-40.944 TL	152	20.75	15.45	
40.945 TL-62.652 TL	153	20.75	16.43	
≥62.653 TL	234	19.25	13.49	
Chronic disease				
No	507	18.50	14.65	0.000*
Yes	119	23.63	14.93	
Health literacy				
Low	351	17.74	14.17	0.008*
High	275	20.86	15.21	
Knowledge of side effects				
No	208	16.17	12.99	0.000*
Yes	418	21.10	15.41	
Reading medication instructions				
Almost never reads	138	16.87	11.98	0.018*
Frequently reads	488	20.21	15.46	

*$p<0.05$

This descriptive cross-sectional field study was designed to assess the comprehensibility of commonly used pharmaceutical pictograms in different

pharmaceutical forms among adults in Türkiye. A total of 626 adults residing in Ankara participated in the study through an online survey. The findings provide valuable insights into the comprehensibility of pharmaceutical pictograms among adults in Türkiye and highlight their role as an effective tool in health communication. Based on the findings, the following conclusions can be drawn.

The first key finding related to the core research question is that the comprehensibility of pharmaceutical pictograms commonly used in medication instructions for different pharmaceutical forms in Türkiye is remarkably low among adults. Of the 12 pictograms included in the study, only one pictogram (P5) met the 67% comprehension criterion set by the International Organization for Standardization (ISO). Based on this finding, it is not possible to conclude that the pharmaceutical pictograms commonly used in Türkiye are an appropriate communication tool for patient information materials. The low guessability scores indicate that participants struggled to interpret the pictograms, suggesting that these visuals are not inherently comprehensible. This result aligns with the assertion by Strauss and Zender (2017) that comprehension of a pictogram depends on both the characteristics of the pictogram itself and the attributes of the individual interpreting it[17]. Dowse (2021)[2] and Pedersen (2019)[18] highlighted that elements such as size, color, simplicity, shape, line thickness, number of components, image contour, contrast ratio, viewing distance, and print quality can affect pictogram comprehension. Furthermore, familiarity with pictograms and visual literacy levels is a fundamental concept that should not be overlooked in pictogram design. In this regard, the study findings suggest that using pictograms without prior testing of their suitability and comprehensibility may limit the expected benefits of visual materials in pharmaceutical communication.

In the study, the average guessability performance scores of participants across 12 pictograms were found to be 19.4%, indicating a very low level of comprehension. This performance is notably lower than the results reported in similar studies[19,20]. This finding suggests that pictograms fail to fully serve their intended purpose of establishing a universal language and are not sufficiently effective as communication tools. The study also revealed that certain socio-demographic variables, such as age, gender, occupation, and income level, influenced the comprehensibility of the pictogram. Specifically, younger participants demonstrated higher comprehension than older participants. This finding supports the assumption that younger individuals, who are more frequently exposed to visual and digital content, may have a greater ability to

quickly interpret symbols and pictograms. Similar results have been reported in previous studies, where younger participants exhibited higher pictogram comprehension levels[3,20-22].

The study found that female participants had higher pictogram comprehension scores compared to male participants. This finding is consistent with the results of previous studies[3,21,23,24,25]. In this context, women's greater sensitivity to health-related issues may have contributed to their more accurate interpretation of pharmaceutical pictograms.

The study found that white-collar professionals had a higher pictogram comprehension score compared to blue-collar workers and individuals in the retiree/homemaker/student group. The literature emphasizes that occupational status significantly influences individuals' access to information and health literacy levels[7]. As white-collar employees tend to be more educated and have greater access to information, they are generally better at interpreting visual symbols such as pictograms. Additionally, these individuals frequently encounter various symbols in their professional environments, which enhances their ability to interpret visual communication elements more effectively. Similar findings have been reported in previous studies, in which working participants demonstrated higher pictogram comprehension levels compared to non-working individuals and students[2,3,20,26].

The analysis based on income levels revealed that participants with incomes above the poverty threshold had higher pictogram comprehension levels compared to those living below the poverty threshold. This finding aligns with the existing literature, which highlights the challenges low-income individuals face in accessing information and developing health literacy[27]. Similarly, studies[18,25] also found that participants with higher incomes demonstrated better comprehension of pictograms. These results suggest that economic status plays a significant role in individuals' ability to interpret pharmaceutical communication materials effectively.

The study found that individuals with chronic illnesses had higher levels of pictogram comprehension. Chronic disease management is a process that often requires individuals to understand, interpret, and apply health-related information in their daily lives[25]. It has been stated that individuals with chronic conditions, who require long-term medication treatment, tend to pay closer attention to medication-related information[11]. Similarly, it is noted that individuals living with chronic illnesses frequently review medication instructions, which gradually improves their health literacy and increases

their awareness of pictograms[26]. Additionally, it has been emphasized that individuals who regularly use medications are more frequently exposed to pharmaceutical information, and this continuous exposure positively influences their ability to comprehend visual materials such as pictograms[10].

The study found that individuals with higher health literacy had better comprehension of pictogram . This finding aligns with the results of previous studies[9,10]. The literature suggests that individuals with higher health literacy are better at interpreting medication-related information, are more conscious when reading patient information leaflets, and have a greater awareness of medication side effects[28]. Additionally, it has been found that individuals with lower health literacy tend to struggle more with pictogram comprehension. However, their study suggested that educational interventions could significantly enhance their ability to interpret health-related visuals and improve their overall health information processing skills[29].

The study found that, similar to health literacy, participants who read medication instructions and were aware of medication side effects had higher guessability scores. Health literacy not only influences the comprehension of pharmaceutical pictograms but also affects the habit of reading medication instructions and understanding potential side effects. It has been emphasized that understanding medication side effects plays a critical role in patient adherence, and enhancing health literacy enables patients to better evaluate such information[11]. Additionally, it has been demonstrated that structured educational programs and patient counseling services significantly improve health literacy and, consequently, the comprehensibility of medication information[30]. These findings highlight that pictograms are more than just visual aids; their effectiveness is directly linked to individuals' capacity to interpret health-related information.

This study has several limitations that should be acknowledged. First, since the study was conducted only in Ankara, the generalizability of the findings to the entire Turkish population may be limited. Individuals from different geographical regions may have varying perceptions of pharmaceutical pictograms due to cultural factors, language barriers, differences in education levels, and disparities in access to healthcare services. Another methodological limitation relates to the use of an online survey as the data collection method. Digital research methods can exclude individuals without internet access or with low digital literacy, thereby affecting the representativeness of the sample and limiting the generalizability of the results.

In conclusion, this study reveals that the comprehensibility of pharmaceutical pictograms in Türkiye is remarkably low, with only one out of twelve pictograms meeting the ISO 9186-1 criteria. The findings highlight that visual health communication tools are not universally understood and are significantly influenced by cultural context, health literacy, and socio-demographic factors. These results suggest that pictograms, in their current form, may not sufficiently ensure medication safety when used as standalone tools in patient information leaflets.

Based on these findings, several practical recommendations are proposed to improve patient safety and medication adherence. The Turkish Medicines and Medical Devices Agency (TITCK) should establish national standards for pharmaceutical pictograms. These symbols must be pilot-tested and validated within the Turkish population before being mandatorily included in patient information leaflets. Pictograms with high error rates (such as P7) should be redesigned using more intuitive imagery that aligns with local cultural perceptions and daily health practices. Since pictograms alone are insufficient, pharmacists and healthcare providers should use these visual aids as 'supportive tools' during face-to-face counseling to reinforce verbal instructions. Educational initiatives and awareness-raising programs should be developed to specifically target elderly populations and individuals with low health literacy, to familiarize them with standardized medical symbols. Further qualitative research, such as focus group interviews, is recommended to understand the specific cognitive reasons behind the misinterpretation of certain pictograms.

STATEMENT OF ETHICS

This study was approved by Başkent University Medical and Health Sciences Research Board and Ethics Committee (Project no: KA24/299, Date: 09.10.2024).

CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

AUTHOR CONTRIBUTIONS

Design, FY; acquisition of data, FY, DGO, ZO; analysis of data, FY, ZO; drafting of the manuscript, FY; critical revision of the manuscript, DGO, ZO; supervision, FY.

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