Pictogram design for an indigenous population: promoting cultural appropriateness in medication use

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ABSTRACT

Objective: Pictograms can mitigate health communication challenges but require tailoring to ensure cultural appropriateness. We aimed to design and validate culture-specific pictograms for an indigenous population in Costa Rica.

Methods: This study was conducted among members of the isolated indigenous Cabécar community of Alto Telire (AT). A total of 24 pictograms were designed based on previously identified labeling needs and grouped into four main groups: health-related problems, family members, pharmaceutical forms, and medication administration instructions. The validation process included face-to-face interviews conducted at three different visits to AT. All pictograms were evaluated based on image comprehension, identification, acceptance, and attractiveness. Modified pictograms were considered valid if, on the third evaluation, comprehension was ≥85% and critical confusion rates ≤5%.

Results: During the first two visits to AT, 44 inhabitants evaluated two sets of 24 pictograms (original and modified), and on the third visit, 20 inhabitants evaluated 16 modified pictograms. After the evaluation and modification processes, 14 (58.3%) pictograms were considered valid and ready for implementation.

Conclusions: Designed pictograms include cultural elements that facilitate their understanding and acceptance by the target population. Our findings confirm that pictogram creation should consider the community´s physical, cultural, and health literacy precise characteristics to be understandable and accepted. The methodology and results of this study can be applied by pharmacists at different levels of care, i.e. hospital pharmacy or primary care.

Keywords: **Health literacy, Drug Labeling, Pictograms, Health Communication, Health of Indigenous Peoples, Pharmaceutical Services, Validation Study.**

Diseño de pictogramas para una población indígena: promoviendo la adecuación cultural en el uso de medicamentos

RESUMEN

Objetivo: Los pictogramas pueden mitigar los desafíos de la comunicación en salud, pero requieren adaptación para garantizar su adecuación cultural. Nuestro objetivo era diseñar y validar pictogramas culturalmente específicos para una población indígena de Costa Rica.

Métodos: Este estudio se llevó a cabo entre miembros de la aislada comunidad indígena Cabécar de Alto Telire (AT). Se diseñaron un total de 24 pictogramas basados en las necesidades de etiquetado previamente identificadas y se agruparon en cuatro categorías principales: problemas relacionados con la salud, miembros de la familia, formas farmacéuticas e instrucciones para la administración de medicamentos. El proceso de validación incluyó entrevistas a persona realizadas en tres visitas diferentes a AT. Todos los pictogramas se evaluaron en función de la comprensión de la imagen, la identificación, la aceptación y la atracción. Los pictogramas modificados se consideraron válidos si, en la tercera evaluación, la comprensión era ≥85% y las tasas de confusión crítica ≤5%.

Resultados: Durante las dos primeras visitas a AT, 44 habitantes evaluaron dos grupos de 24 pictogramas (originales y modificados), y en la tercera visita, 20 habitantes evaluaron 16 pictogramas modificados. Después de los procesos de evaluación y modificación, se consideraron válidos y listos para su implementación 14 (58.3%) pictogramas.

Conclusiones: Los pictogramas diseñados incluyen elementos culturales que facilitan su comprensión y aceptación por parte de la población objetivo. Nuestros hallazgos confirman que la creación de pictogramas debe tener en cuenta las características físicas, culturales y de alfabetización en salud de la comunidad para ser comprensibles y aceptados. La metodología y los resultados de este estudio pueden ser aplicados por farmacéuticos en diferentes niveles de atención, como la farmacia hospitalaria o la atención primaria.

Palabras clave: **Alfabetización en Salud, Etiquetado de Medicamentos, Pictogramas, Comunicación en Salud, Salud de Poblaciones Indígenas, Servicios Farmacéuticos, Estudio de Validación.**

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INTRODUCTION

Accessing healthcare services can be challenging for indigenous populations, regardless of location or socio-political situation[1]. Additionally, cultural differences and low levels of health literacy can make it difficult for them to communicate with healthcare providers and understand medication instructions[2,3]. These barriers can lead to irrational medication use, resulting in significant health consequences and high costs for healthcare systems[4].

Understanding medication instructions is crucial to ensure effective treatment and avoid errors, misinterpretations, and limited self-care[5,6]. Pictograms are symbols, drawings, or figures representing a concept or idea, and can facilitate the cognitive learning process, direct patient care to relevant details, and reduce reliance on complex written information[7]. Pictograms have proven to foster medication use and assist people with limited literacy skills[8,9] who may need extra help to avoid misunderstandings when receiving oral explanations or remembering specific information[10].

Pictograms transcend cultural, linguistic, and cognitive boundaries by guiding, informing, educating, and disseminating messages[11]. Nevertheless, they require tailoring to ensure cultural appropriateness, reflect the population's lifestyle, clothing, hairstyles, and eating habits, and must relate to their reading ability and visual skills[5,6]. There is evidence from other regions that designing pictograms for specific populations, such as the illiterate[12] or indigenous[15,13], can be successful.

Costa Rica is an upper-middle-income country located in Central America[14]. Its indigenous population continues to face disadvantages in different social, cultural, and economic areas[15]. The Caja Costarricense de Seguro Social (CCSS), the public institution in charge of providing public health services in the country, uses twelve images to illustrate dosage forms and administration routes as an alternative for those who have trouble reading or understanding traditional drug labels. These pictograms are based on the analysis of a diverse population, including indigenous, illiterate, and visually impaired people[16].

More recently, Mora Vicarioli et al[17] presented data on the underserved and difficult-to-access indigenous Costa Rican community of Alto Telire (AT). The study found low levels of education and health literacy among participants, who used physical characteristics, package instructions, and family members' names to identify their medications. Based on this analysis, this study aims to describe the processes followed to design and validate culture-specific pictograms for the AT indigenous population in Costa Rica.

MATERIALS AND METHODS

This study was conducted through an observational and prospective approach. The research team consisted of a graphic designer and three pharmacists, one of whom worked at the CCSS healthcare clinic that provides services to the targeted population. This pharmacist also acted as the interviewer.

Study setting and population

Costa Rica has eight indigenous groups, each with its own language, cultural beliefs, worldview, and values. These groups make up a total of 24 indigenous territories[18]. This study was specifically conducted in AT, an isolated indigenous population located in a mountainous area of the province of Limón. The participants were part of the Cabécar indigenous population, but the AT population has distinct characteristics that are not shared by the rest of the Cabécar or any other indigenous group in the country.

Accessing this population is challenging, requiring a five-day hike or a trip by helicopter. The population receives routine medical care and medications every three to six months, depending on weather and transportation availability, in a nontraditional healthcare setting. Due to the extended periods they spend without access to medical services, they tend to accumulate pharmaceutical products to treat their health-related problems. When CCSS teams visit this location, an estimated 680 people receive medical attention[17] based on Western or conventional medicine, and professionals stay for three days, providing attention on a 7 a.m. to 4 p.m. schedule.

To be eligible for participation in the study, individuals needed to be 18 years old or older, born in AT, without visual or cognitive disabilities, and able to speak Spanish or Cabécar. Informed consent forms were available in both languages, and a native speaker, a pharmacy technician at CCSS, provided simultaneous interpretation to Cabécar. Every person who met the eligible criteria was invited to participate in the evaluation process. Due to the complexity of accessing this population, it was impossible to include the same participants in every evaluation.

This study received approval from the Research Ethics Boards of the Universidad de Costa Rica (VI-1812-2018) and Caja Costarricense de Seguro Social (CENDEISSS-AB-13306-2017).

Pictogram design

A graphic designer created an initial set of 24 pictograms (Figure 1) using previously collected information[17] and data compiled by team members during previous visits to AT. This information includes physical characteristics, clothing, diet, general lifestyle, and housing characteristics. After analyzing the data from the first evaluation of original versions, in November of 2018, the graphic designer received additional photographic evidence to modify all images. Pencil drawings were digitized and colored using Adobe Photoshop CC.

The images were grouped into four categories: health-related problems, family members, pharmaceutical forms, and medication administration instructions. Nine pictograms represented common health problems; seven included family members who usually share a home and, therefore, whose medications are stored together in their place of living; five focused on commonly used pharmaceutical forms; and three images provided information on medication administration instructions. Each pictogram was color-printed on an individual card with no additional information included.

Pictogram validation

From November 2018 to March 2021, a total of three evaluations were conducted during different visits to AT to validate the pictograms. The pictograms evaluated during the first visit were considered the 'original version,' while the 'modified version' referred to those used in the second and third visits.

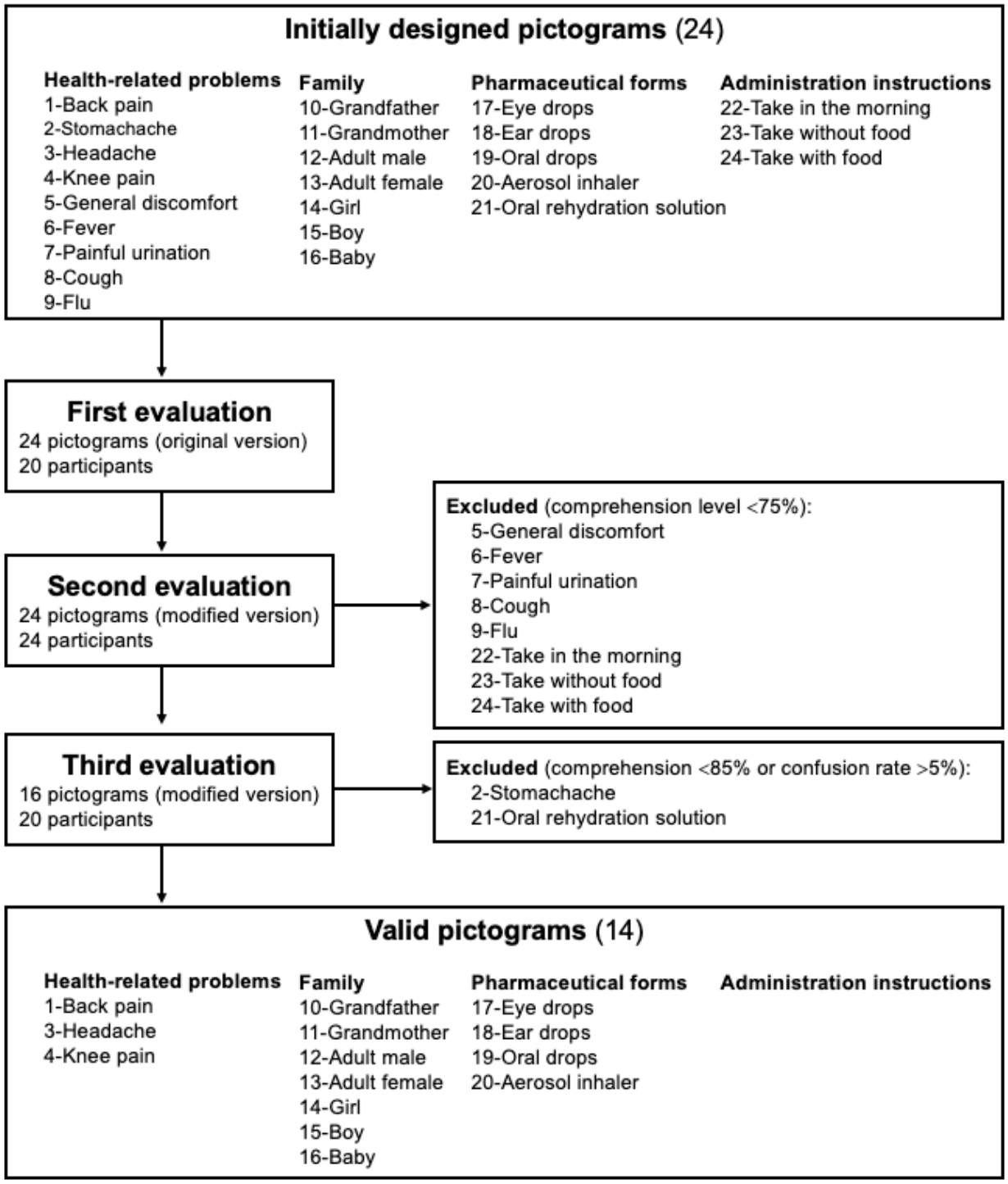
The first two evaluations included all 24 pictograms.

Only those pictograms comprehended by 85% or more of the total population[19] in the second evaluation proceeded to a third and final evaluation. If the research team deemed the topic as a priority, pictograms with comprehension levels of 75% were also approved for inclusion in the third evaluation. To be valid and ready for implementation, the pictograms had to be comprehended by 85% or more participants and have a maximum of 5% critical confusion (i.e., no more than 5% of the respondents provided opposite interpretation)[19] in the third evaluation.

The three on-site evaluations were conducted through face-to-face interviews lasting 40 to 60 minutes. During the interviews, participants received an explanation of the study's purpose and how pictograms communicate medication instructions to patients who could not read[13, 20, 21]. The pictograms were randomly presented to the study participants during all interviews.

Every pictogram was coded using a number and name i.e., 1-Back pain. A pharmacist conducted, transcribed and rated all interviews using questions included in a previously published questionnaire[22] (Table 1). Answers were categorized as correct, partially correct, or incorrect.

Figure 1. Description of the pictogram evaluation process.



This study examined four key parameters: comprehension, identification, acceptance, and attractiveness. Comprehension was measured by the percentage of respondents whose image interpretation was consistent with the intent of the research team (correct answers), and confusion rates as the percentage of respondents who provided an opposite view (incorrect answers). Identification assessed how many respondents felt the image was relevant to their community (correct answers). Acceptance measured how many respondents agreed that the clothing was representative of the AT population and expressed a desire for their medications to be labeled with such images. Finally, attractiveness measured the percentage of respondents who found pictograms and colors appealing.

During the first and second evaluations, participants assessed all four parameters while being presented with a 10 cm x 10 cm color-printed board. On the final visit, participants were presented with smaller versions of the board (9 cm x 9 cm, 3 cm x 3 cm, and 2.5 cm x 2.5 cm) to determine the most appropriate size for printing and to test comprehension.

Demographic data, including gender, age, and the highest level of formal education achieved, was collected at all three visits.

Data analysis

Data was analyzed using frequencies, and percentages, and the Chi-square test was utilized to examine comprehension and the impact of demographic variables on pictogram interpretation. IBM SPSS Statistics Version 20.0 was used for analysis at a significance level of 5%.

RESULTS

In two visits to AT, 44 inhabitants evaluated two sets of 24 pictograms (original and modified versions), while 20 inhabitants evaluated 16 modified pictograms in a third visit. Figure 1 provides a detailed description of the evaluation process. However, due to accessibility issues, different samples were used for each evaluation, as shown in Table 2.

The sample for the first evaluation was primarily composed of women aged 26 to 45 years old, with incomplete or without primary education. In contrast, the second and third evaluation samples consisted of a higher proportion of men within the same age range and education levels. Nonetheless, statistical analysis revealed no significant differences between the study groups.

Table 3 shows the results of the three evaluations, including comprehension, acceptance, and identification. During the first evaluation, 17 of the original pictograms

Table 1. Parameters assessed in pictogram evaluations

Parameter	Question	Answer option
Comprehension	*'Express in your own words the meaning of every image'*	Open answer
Identification	*'Where do you think the person in the picture is from?'*	Open answer
	'Why do you consider that the person in the image is not cabécar?' (If the answer was something different from cabécar)	Open answer
Acceptance	*'Do you think that the clothes of the people you see in the image are similar to those used by the Alto Telire population?'*	*'Yes'* or *'No'*
	Participants were also prompted to indicate:	
	*'What would you change in the image?'**	Open answer
	'What do you think about using these images to label your medications?'	*'I like it', 'I do not like it'*, or *'I do not have an opinion'*
Attractiveness	*'Do you like the image?'*	*'Yes'* or *'No'*
	'Why?'* and *´What would you change about them?'**	Open answer
	'Do you like the colors of the image?'	*'Yes'* or *'No'*

*If the answer to the above question was 'No'

Table 2. Sociodemographic characteristics of participants per evaluation

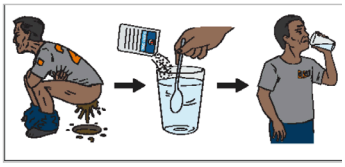
	First evaluation (n = 20)	Second evaluation (n = 24)	Third evaluation (n = 20)
Gender, n (%)			
Male	9 (45.0)	15 (62.5)	13 (65.0)
Female	11 (55.0)	9 (37.5)	7 (35.0)
Age, n (%)			
18-22	8 (40.0)	6 (25.0)	7 (35.0)
26-35	7 (35.0)	9 (37.5)	4 (20.0)
36-45	4 (20.0)	7 (29.2)	4 (20.0)
46-55	1 (5.0)	2 (8.3)	3 (15.0)
56-65	0 (0.0)	0 (0.0)	2 (10.0)
Education, n (%)			
No formal education	11 (55.0)	13 (54.0)	13 (65.0)
Incomplete elementary school	5 (25.0)	6 (25.0)	1(5.0)
Complete elementary school	4 (20.0)	5 (21.0)	6 (20.0)

Table 3. Comprehension, acceptance, and identification of Original and Modified versions of pictograms

Pictogram	Comprehension / Confusion rate (%)			Acceptance (%)		Identification (%)	
	Original version[a]	Modified version[b]	Modified version[c]	Original version[a]	Modified version[b]	Original version[a]	Modified version[b]
Health-related problems							
1- Back pain	85,0 /0	95,8 /0	100,0 /0	60,0	100,0**	60,0	95,8***
2- Stomach ache	90,0 /5,0	79,2 /16,7	65,0 /20	50,0	100,0**	55,0	95,8***
3- Headache	95,0 /5,0	100,0 /0	100,0 /0	70,0	100,0**	65,0	96,0***
4- Knee pain	100 /0	100,0 /0	100,0 /0	55,0	100,0**	55,0	100,0***
5- General discomfort	45,0 /55,0	12,5* /87,5	♦	60,0	100,0**	65,0	95,8***
6- Fever	5,0 /70,0	29,2* /54,2	♦	45,0	100,0**	60,0	95,8***
7- Painful urination	85,0 /5,0	77,3 /0	♦	60,0	100,0**	60,0	95,5***
8- Cough	65.0 /30,0	33,3* /4,2	♦	55,0	100,0**	60	95,8***
9- Flu	85,0 /15,0	62,5 /25,0	♦	60,0	100,0**	65,0	95,8***
Family members							
10- Grandfather	100,0 /0	100,0 /0	100,0 /0	55,0	100,0**	60,0	96,0***
11- Grandmother	100,0 /0	100,0 /0	100,0 /0	65,0	100,0**	65,0	95,8***
12- Adult male	90,0 /0	100,0 /0	100,0 /0	45,0	100,0**	40,0	95,7***
13- Adult female	85,0 /10,0	100,0 /0	95,0 /5	55,0	100,0**	65,0	96,2***
14- Girl	95,0 /5,0	100,0 /0	100,0 /0	30,0	100,0**	30,0	91,7***
15- Boy	95,0 /0	100,0 /0	100,0 /0	70,0	100,0**	70,0	96,0***
16- Baby	100,0 /0	100,0 /0	100,0 /0	40,0	100,0**	40,0	95,8***
Pharmaceutical forms							
17- Eyedrops	100,0 /0	100,0 /0	100,0 /0	20,0	100,0**	55,0	95,8***
18- Ear drops	100,0 /0	100,0 /0	100,0 /0	35,0	100,0**	55,0	95,8***
19- Oral drops	85,0 /15,0	100,0 /0	100,0 /0	45,0	100,0**	55,0	87,0***
20- Aerosol inhaler	90,0 /0	79,2 /16,7	100,0 /0	35,0	100,0**	60,0	95,8***
21- Oral rehydration solution	50,0 /10,0	82,6* /0,0	30,0 /0	60,0	100,0**	55,0	91,3***
Administration instructions							
22- Take in the morning	5,0 /80,0	37,5* /33,3	♦	0,0	100,0**	0,0	95,8***
23- Take without food	0 /85,0	29,2* /45,8	♦	0,0	100,0**	0,0	95,8***
24- Take with food	25,0 /75,0	47,8 /17,4	♦	0,0	100,0**	10,0	95,7***

[a]First evaluation; [b]Second evaluation; [c]Third evaluation; Name in bold indicates pictograms considered valid at the end of the study; *Statistically significant difference between a and b values in the highest value of the comparison, talking about comprehension; **Statistically significant difference between a and b values in the highest value of the comparison, talking about acceptance; ***Statistically significant difference between a and b values in the highest value of the comparison, talking about identification; ♦ Pictograms not included in the third evaluation due to the low percentage of comprehension obtained in previous evaluations.

Table 4. Examples of pictograms (original and modified), common misinterpretations, and recommendations for improvement

Original version		Modified version	Original version		Modified version
Common misinterpretation	Recommendations for improvement	Common misinterpretation	Common misinterpretation	Recommendations for improvement	Common misinterpretation
1-Back pain			**13-Adult female**		
					
Fever, kidney pain	Patterned clothing	-	Girl, old lady	Loose hair, patterned clothing	-
6-Fever			**17-Eye drops**		
					
Sleeping, pregnant, head ache	Include a thermometer	Toothbrush in mouth,smoking, sick person,stomachache	-	-	-
10-Grandfather			21-Oral rehydration solution		
					
-	Patterned clothing	-	Asthma	There are no toilets	Crying, having some kind of illness or disease

Name in bold indicates pictograms considered valid at the end of the study

(70.8%) were understood by more than 85% of the participants. However, three pictograms (9-Flu, 13-Adult female, and 19-Oral drops) had confusion rates higher than 5.0%, and acceptance and identification percentages were lower than 70.0% for all pictograms. Thus, all original pictograms underwent significant modifications in elements such as clothing and housing characteristics.

The second evaluation, using the pictograms' modified version, revealed that two-thirds of the images were understood by ≥85% or ≥75% (when the topic addressed was considered a priority) of the participants. Overall, all pictograms improved in terms of acceptance (100.0% of participants) and identification (at least 87.0% of participants), and 12 pictograms had an increased percentage of participants comprehending their meaning accurately. All participants also reported liking the images and color palette selected, and they would like their medications labeled with these pictograms.

In the final evaluation, almost all participants (95%) accurately comprehended 14 out of the 16 modified pictograms. Moreover, all had confusion rates lower than 5% and were considered valid. Notably, 11 of the 14 valid pictograms had comprehension rates higher than 85% and confusion rates lower than 5% in all three evaluations. These pictograms included 1-Back pain, 3-Headache, 4-Knee pain, 10-Grandfather, 11-Grandmother, 12-Adult male, 14- Girl, 15-Boy, 16-Baby, 17-Eyedrops, and 18-Eardrops. Examples of the original and modified pictograms, along with their common misinterpretations and recommendations for improvement, are presented in Table 4. All pictograms are available in Table S1 of the Supplementary material.

Sub-analyses of comprehension, acceptance, and identification considering age, education level, and gender were not possible due to the small sample size of the study. Lastly, when presented with pictograms in three size options, most participants preferred the 3cm x 3cm option (Detailed information in Table S2 of Supplementary material).

DISCUSSION

This study focuses on design and validation of medication labeling pictograms for an illiterate indigenous population in Costa Rica. The team initially designed 24 pictograms based on the population's specific needs, and 14 (58.3%) were deemed valid after evaluation and modification.

The design process began with written descriptions of their characteristics, but feedback from participants showed that elements such as clothing, hairstyles, and utensils were not typical of their community. Consequently, images were modified improving acceptance rates for all pictograms. For example, the original version of Pictogram 21-Oral Rehydration solution included a toilet, an object unknown to the target population that was replaced by holes in the ground (See Table 4). Furthermore, pictograms 22-Taking in the morning, 23-Take without food, and 24-Take, included a traditional bowl that this population does not currently use and needed to be replaced.

These results are consistent with previous findings[20,23] and confirm that culture-related factors impact image perception[24]. In addition, when creating pictograms, variables such as objects, clothing, eating utensils, and environment should be as similar as possible to those observed in the target population, giving a greater chance of achieving a better understanding.

Adequate comprehension (≥85%) and confusion (≤5%) rates were observed in 11 (78.6%) pictograms. Notably, almost all pictograms under the family category were considered valid, which is remarkable since participants come into family groups to receive medical attention, but only one family member picks up all medicines. Although each medication is individually labeled, factors such as low literacy and the high number of drugs prescribed when medical care is provided every three to six months require special attention. Therefore, associating each medication with a family member using a pictogram could prevent medication errors.

Pictogram interpretation relies on the educational level and the development of visual literacy skills of the target population[25]. For this reason and its complexity, image sequences tend to achieve a lower level of understanding[26]. In our case, on one hand, pictogram 21-Oral rehydration solution and all included in the Administration instructions category (22, 23, and 24) are examples of these complications. Even after a statistically significant improvement in the comprehension parameter due to major modifications, only pictogram 21 was finally considered valid for this study. On the other hand, in the health-related problem category, only three out of the initial nine pictograms were considered valid and ready to be used. A possible reason for the low number of pictograms successfully developed in this category is that the Cabécar concept of health problems needs further exploration and understanding. As stated by Mansoor et al[27] "modifying, retesting and refining process, although costly, time-consuming and labor-intensive, is unavoidable if a favorable outcome is desired." Consequently, all these pictograms will be re-conceptualized and re-designed for future testing.

The creation of pictograms is a process that should involve and comprehend the context and needs of the target population[3,21]. For instance, Mansoor et al[27] used a consultative approach to evaluate the acceptance of a new pictogram sequence in a low-literate population; another study evidenced that 50% of participants, coming from three different cultures interpreted correctly 11 of the 16 initially tested pictograms and, even after modifying conflicting components within the images, less than 70% of the population correctly interpreted the intended message[20]. Furthermore, Grenier et al[21] re-designed pictograms to be culture-specific for six aboriginal communities and conducted focus groups for image validation. Other studies have compared pictograms designed for specific ethnic groups with the United States Pharmacopeia- Drug Information pictograms[5,13], concluding that images developed locally are more successful in obtaining correct interpretations.

Actions designed to improve health literacy must be culturally adapted, and not the other way around as is often the case in healthcare systems. When addressing the issue of health literacy in an indigenous community, we suggest using a population-centered approach where healthcare professionals and systems look to understand the community and find ways to reduce communication barriers.

Evaluation of the attractiveness of images and the palette of colors used in our study was a successful strategy, and all participants indicated that they would like their medications labeled with them. Certainly, attractiveness helps

designs to be valued, arouse interest, and attracts attention[22]; this parameter is related to its visibility, which includes factors such as contrast, size, color, shape, and style[28]. As an example, to emphasize the message we wanted to deliver in pictograms 17-Eye Drops, 19-Oral Drops, and 18-Ear Drops, the size of the dropper was increased as suggested by van Beusekom et al[23]. Furthermore, participants selected the best size for pictogram reproduction as this is a factor that assists people in getting the message that wants to be transmitted[28,29] and is particularly important for limited literacy viewers[30].

The present study took a rigorous approach to pictogram validation, following well-described recommendations on designing and reporting pictogram-related research[30], and considering issues previously noted as problematic or inadequately addressed[23,24,28,30]. We carefully described the study design, site and population, and reported information like the number of pictograms, its randomization, the use of colors, size, interviewing time, and score allocation.

Additionally, among the strengths of this study, the research team consisted of three pharmacists and a graphic designer who oversaw all the designing principles. One of the pharmacists, part of the on-site healthcare team, knows the population since her previous visits to AT and understands the attention process followed by the healthcare team. We provided access to the populations' native language and had the collaboration of an interpreter that was a community member; these actions aided in overcoming a main communication barrier.

Furthermore, alongside comprehension, we assessed end-user preferences for the final product size, and the target group was involved in the iterative design-evaluation-re-design processes. Moreover, this paper shows examples of pictogram changes regardless of their evaluation results.

As previously described, AT is a difficult-to-access population. Consequently, a limitation of this study is that the randomization of participants was impossible to incorporate into its design, and results should be interpreted with caution, as they may not represent the needs and perceptions of all AT inhabitants. In addition, the small sample size limited the possibility of further statistical sub-analyses. To minimize bias, we used a convenience sample and voluntary participation during every visit to AT.

Pictogram design taking the needs and context of a specific indigenous population into account led us to rethink what has been traditionally stated: "not to use pictograms as the only means of health communication" (36). As we explored the cultural and literacy characteristics of the AT population and the irregularity in the provision of health services, we must suggest that for a significant part of them, pictograms may be the only tool for obtaining information on medicines for several months. Therefore, the implementation process of the images validated in this study becomes critical; however, it is also relevant to design a methodology to evaluate its practical application and further influence the correct use of medication. The methodology and results of this study can be applied by pharmacists at different levels of care, i.e. hospital pharmacy or primary care.

CONCLUSIONS

More than half (60%) of the culture-specific pictograms designed for the AT indigenous population in Costa Rica met the validation criteria proposed in this study. Our findings support the premise that accessing the population's needs and considering the characteristics of the target population at every step of the process is likely to be fruitful. At the same time, it provides evidence that in groups with low levels of health literacy and visual skills, designing effective pictograms is a challenging process that needs to be studied in further detail.

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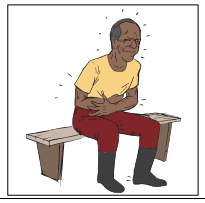
Table S1.
Original and modified version of all pictograms

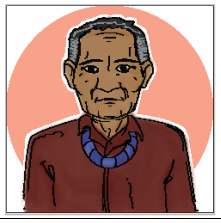
	Original version	Modified version
1-Back pain		
2-Stomachace		
3-Headache		
4-Knee pain		
5-General Discomfort		
6-Fever		

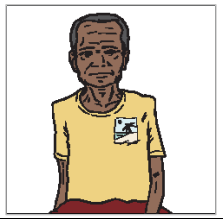
7-Painful urination

8-Cough

9-Flu

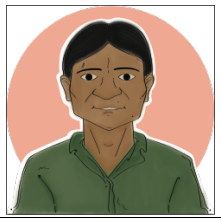
10-Grandfather

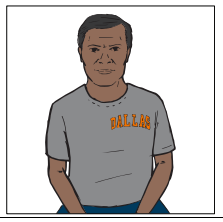




11-Grandmother

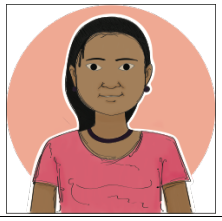
12-Adult male

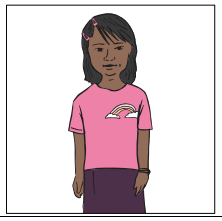




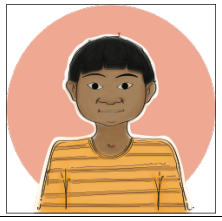
13-Adult female

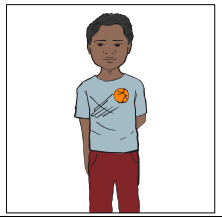
14-Girl



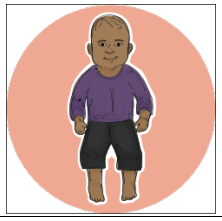


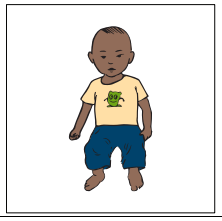
15-Boy





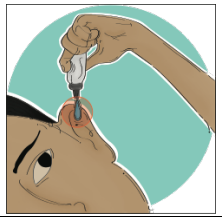
16-Baby



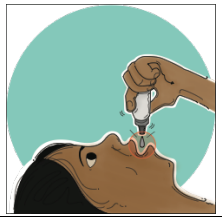


17-Eye drops

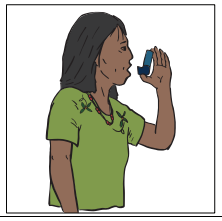
18-Ear drops



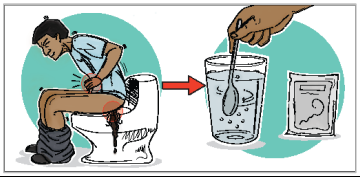
19-Oral drops

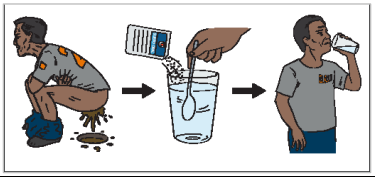


20-Aerosol inhaler

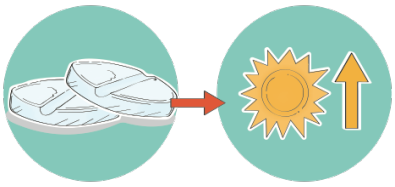


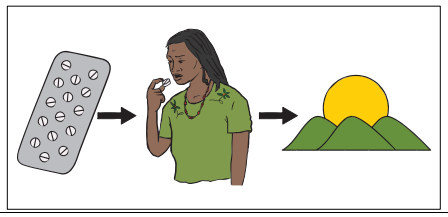
21-Oral rehydration solution



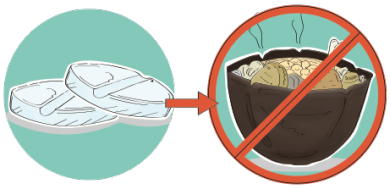


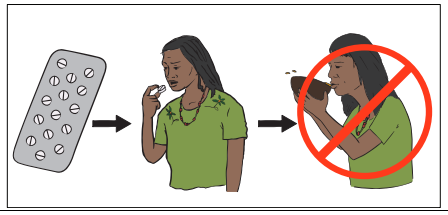
22-Take in the morning



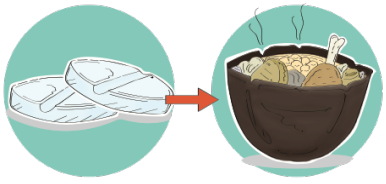


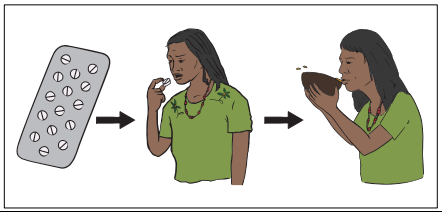
23-Take without food





24-Take with food





Name in bold indicates pictograms considered valid at the end of the study

Table S2.
Size preference of the pictograms evaluated in the third evaluation (n=20)

Pictogram	2.5 cm x 2.5 cm n (%)	3 cm x 3 cm (%) n (%)	9 cm x 9 cm (%) n (%)
Health-related problems			
1- Back pain	5 (25)	14 (70)	1(5)
2- Stomach ache	6 (30)	12 (60)	2(10)
3- Headache	7 (35)	12 (60)	1(5)
4- Knee pain	4 (20)	14 (70)	2(5)
Family members			
10- Grandfather	5 (25)	13 (65)	2(10)
11- Grandmother	9 (45)	10 (50)	1(5)
12- Adult male	7 (35)	12 (60)	1(5)
13- Adult female	5 (25)	13 (65)	2(10)
14- Girl	5 (25)	14 (70)	1(5)
15- Boy	5 (25)	14 (70)	1(5)
16- Baby	5 (25)	12 (60)	3(15)
Pharmaceutical forms			
17- Eye drops	4 (20)	15 (75)	1(5)
18- Ear drops	9 (45)	9 (45)	2 (10)
19- Oral drops	10 (50)	9 (45)	1 (5)
20- Aerosol inhaler	4 (20)	13 (65)	3 (15)