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Application of the Northwest Residential Habitability Scale in Culiacán

Aplicación de la Escala de Habitabilidad Residencial del Noroeste en Culiacán

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ABSTRACT

Housing habitability in northwestern Mexico is shaped by the hot climate and by recent housing production. Using the preliminary data cut from the pilot survey of project FZ-HAB-0034 on the Factoriza UAS platform, this study described the initial behaviour of the Northwest Residential Habitability Scale in Culiacán, with twenty-five items and five dimensions: Dwelling comfort, Space and functionality, Dwelling safety, Dwelling services and Immediate surroundings. With a cross-sectional design, 9 cases out of a target of 100 were analysed while data collection remained open. Descriptive statistics, Cronbach's alpha, McDonald's omega total and Spearman correlations between dimensions were estimated, and an exploratory factor analysis was attempted. Internal consistency was acceptable for Space and functionality (α = .800; ω = .842), Safety (α = .791; ω = .850) and Services (α = .748; ω = .863), and low for Comfort (α = .490) and Immediate surroundings (α = .288). The factor analysis was not interpretable because the sample had fewer cases than items, and the dwelling-related dimensions were highly intercorrelated. Residents rated their dwellings as safe and well served, but hot in summer and located in streets perceived as unsafe at night. The findings do not yet provide structural validity evidence and point to revisions of the instrument.

Keywords: housing habitability; residential satisfaction; thermal comfort; psychometric evidence

RESUMEN

La habitabilidad de la vivienda en el noroeste de México está marcada por el clima cálido y por la producción habitacional de las últimas décadas. Este estudio describió, en el corte preliminar del levantamiento piloto del proyecto FZ-HAB-0034 de Factoriza UAS, el comportamiento inicial de la Escala de Habitabilidad Residencial del Noroeste en Culiacán, de veinticinco reactivos y cinco dimensiones: Confort de la vivienda, Espacio y funcionalidad, Seguridad de la vivienda, Servicios de la vivienda y Entorno inmediato. Con diseño transversal, se analizaron 9 casos de una meta de 100, con el levantamiento abierto. Se estimaron descriptivos, alfa de Cronbach, omega total y correlaciones de Spearman entre dimensiones, y se intentó un análisis factorial exploratorio. La consistencia interna fue aceptable en Espacio y funcionalidad (α = .800; ω = .842), Seguridad (α = .791; ω = .850) y Servicios (α = .748; ω = .863), y baja en Confort (α = .490) y Entorno inmediato (α = .288). El análisis factorial no fue interpretable porque la muestra tiene menos casos que reactivos, y las dimensiones referidas a la vivienda se correlacionaron de manera alta entre sí. Los residentes valoraron sus viviendas como seguras y con servicios adecuados, pero calurosas en verano y en entornos inseguros de noche. Los resultados no aportan todavía evidencias de validez estructural y orientan la revisión del instrumento.

Palabras clave: habitabilidad de la vivienda; satisfacción residencial; confort térmico; evidencias psicométricas

INTRODUCTION

Housing habitability is a central condition of urban well-being. It is not limited to having a roof overhead; rather, it encompasses thermal, acoustic, and lighting comfort, the adequacy and functionality of space, physical safety and security of tenure, access to services, and the quality of the immediate surroundings.

Recent reviews of residential satisfaction and the social sustainability of housing describe this assessment as multidimensional, involving functional, environmental, economic, social and psychological factors that encompass both the dwelling unit and the neighborhood (Alaie et al., 2022; Saleem and Alchalabi, 2025).

In northwestern Mexico, housing habitability is shaped by the hot climate and by the characteristics of housing production over recent decades. During the first two decades of this century, social housing was built on a large scale, with small dwellings, developments far from urban centers, insufficient services, and a high number of abandoned homes (Hernández Ilizaliturri et al., 2025).

In Culiacán, residents of a social housing development described their homes as very hot and kept their air conditioning running, even though most of the dwellings fell within a comfort range calculated for the city (Barraza-Bracamontes et al., 2022).

The city, described as an agro-city, also exhibits surface heat islands whose intensity varies with the season and with land use in the periphery (Borbolla Gaxiola et al., 2024).

Measuring habitability from the perspective of those who live in the dwelling makes it possible to complement census indicators and technical assessments with everyday experience. This requires instruments with validity evidence in the regional context. Project FZ-HAB-0034 of the Factoriza UAS platform set out to administer, in Culiacán, a residential habitability scale designed for northwestern Mexico; the scale comprises twenty-five items organized into five dimensions: Housing Comfort, Space and Functionality, Housing Safety, Housing Services, and Immediate Surroundings.

This article reports the results of the first pilot survey of the scale in Culiacán, based on a very small preliminary data cut. Its scope is therefore limited to an initial examination of the instrument's behavior in that city and does not extend to estimating population parameters.

The overall objective was to describe the initial behavior of the Northwest Residential Habitability Scale in the preliminary data cut from its administration in Culiacán. The specific objectives were: first, to describe the distribution of responses to each item; second, to estimate the internal consistency of each dimension using alpha and omega coefficients; third, to assess the feasibility of an internal structure analysis with the available sample size; and fourth, to explore the relationships among the scores on the five dimensions. The project package records no hypotheses, so the study is descriptive and exploratory in scope.

DEVELOPMENT

RESIDENTIAL HABITABILITY AS A MULTIDIMENSIONAL CONSTRUCT

Research on residential satisfaction has sought to identify which housing and neighborhood conditions are associated with a favorable assessment.

Saleem and Alchalabi (2025) systematically reviewed forty studies and highlighted the quality of architectural design, environmental sustainability and socioeconomic conditions. They grouped the factors into twelve interacting categories, ranging from functional and technical to cultural, psychological and public policy categories.

From a social sustainability perspective, the review by Alaie et al. (2022) organized housing indicators into five dimensions (functional, semantic-perceptual, physical, environmental, and economic) covering aspects that range from services and social interaction to the scale of the housing unit and the neighborhood, natural surveillance, and affordability.

Widely used instruments are available for measuring perceived residential environment quality. In China, the Chinese version of the Perceived Residential Environment Quality Indicators, which covers architectural and urban planning, socio-relational, functional, and contextual aspects, was administered to 1,158 retired residents; perceived quality and its subdimensions were generally positively correlated with sense of community (Zhao et al., 2025).

These instruments show that perceived habitability can be organized into related but distinguishable facets, a premise shared by the scale applied in the present study.

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THE DIMENSIONS OF THE SCALE

The Comfort dimension of housing captures pleasant indoor temperature (R1), low street noise (R2), the entry of natural light (R3), air circulation (R4), and the experience of heat in summer (R5, reverse-scored). In hot climates, thermal comfort is the most demanding facet.

In Hermosillo, a comparison of the predominant social housing type with a dwelling built to energy efficiency standards showed higher emissions for the former (Muñoz López et al., 2023). In Culiacán, heat was the feature most frequently reported by social housing residents (Barraza-Bracamontes et al., 2022).

The Space and functionality dimension captures the adequacy of space for the people living in the dwelling (R6), a place to sleep for each person (R7), the comfort of the kitchen (R8), the lack of space to store belongings (R9, reverse-scored), and a layout that facilitates daily activities (R10).

In northwestern Mexico, studies of social housing users have found moderate levels of satisfaction, associated with the housing development in which each dwelling is located (Valdivia Haro et al., 2023). In Culiacán, most residents reported being satisfied with their homes, although they considered the spaces insufficient (Barraza-Bracamontes et al., 2022).

In subsidized housing estates in Guangzhou, Tang et al. (2024) associated greater satisfaction with larger dwellings, well-equipped neighborhoods, close neighborly ties, and community activities.

The Housing security dimension combines physical security, reflected in the condition of the roofs (R11), the secure locking of the doors (R13) and the absence of cracks in the walls (R14, reversed), with the feeling of safety inside the dwelling (R12) and the security of being able to keep living there (R15), which refers to tenure. The Housing services dimension covers the continuity of the water supply (R16), the stability of the electricity supply (R17), the functioning of the drainage system (R18), frequent water outages (R19, reversed) and the internet connection (R20).

The Immediate Surroundings dimension covers street paving (R21), proximity to a grocery store (R22), street lighting at night (R23), feeling unsafe when walking along the street at night (R24, reverse-scored) and proximity to public transportation (R25). The location and amenities of the surrounding area are a substantive component of habitability: in Mexico City, residents of a peripheral housing development had much longer commuting times than residents of an informal community closer to the city center, which had a well-established local commercial economy (Reyes, 2023).

The vulnerability of housing to extreme events also depends on the surrounding environment. In Culiacán, the 2018 flooding associated with Tropical Depression 19-E affected neighborhoods of different income levels, but recovery was harder for low-income households living in fragile structures (Mancera González, 2021).

Organizing the items into five dimensions assumes that each facet is internally consistent and distinguishable from the others. This assumption must be tested empirically, because items that combine physical conditions with subjective appraisals, or the interior of the dwelling with its surroundings, may behave heterogeneously. In addition, because the design is cross-sectional, the relationships between dimensions must be understood as associations rather than as dependency relationships.

METHODOLOGY

DESIGN

A quantitative, non-experimental, cross-sectional study with a descriptive and exploratory scope was conducted. The data come from survey LEV-0039, “Piloto Culiacán · Escala de habitabilidadresidencial” (Culiacán Pilot · Residential Habitability Scale), from project FZ-HAB-0034 on the Factoriza UAS platform, and from the frozen dataset DST-0036, with a data cutoff date of 9 October 2026. The survey is an independent sample and the only one in the project; its data are not combined with those from administrations of the scale in other cities.

POPULATION, SAMPLE, AND DATA CUTOFF

The survey population was defined as persons aged 18 years or older residing in a dwelling in Culiacán. The neighborhoods (colonias) were selected by the project lead, so the selection was non-probabilistic. According to the Factoriza log, 14 people opened the questionnaire and

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9 completed it. No cases were excluded for quality control, leaving 9 cases for analysis (Table 2).

The analyzed data cut is preliminary: it comprises 9 cases out of a target of 100, and data collection was still open, in the fieldwork phase, as of the cut-off date. With 9 cases for 25 items, the ratio is 0.4 cases per item, so the inter-item correlation matrix is not invertible. The adequacy of the data and of the sample is the first condition that the methodological literature asks researchers to verify in item factor analysis (Ferrando et al., 2022; Goretzko et al., 2021).

INSTRUMENT

The Culiacán version of the Northwest Residential Habitability Scale (Escala de Habitabilidad Residencial del Noroeste) was administered. It comprises twenty-five items with a five-point response format, ranging from Strongly disagree (1) to Strongly agree (5). The items are organized into five dimensions of five items each: Housing comfort (R1 to R5), Space and functionality (R6 to R10), Housing safety (R11 to R15), Housing services (R16 to R20), and Immediate surroundings (R21 to R25). Five items are reverse-worded, one per dimension (R5, R9, R14, R19, and R24), and are already recoded in the data matrix. After recoding, a higher score indicates better habitability across all dimensions. Table 1 presents the code, dimension, wording, and direction of each item.

Table 1. Structure of the instrument.

Code	Dimension	Item	Reverse
R1	Housing comfort	The temperature inside my home is pleasant	No
R2	Housing comfort	Inside my home, I hear little noise from the street	No
R3	Housing comfort	My home receives natural light during the day	No
R4	Housing comfort	Air circulates inside my home	No
R5	Housing comfort	I feel too hot inside my home in summer	Yes
R6	Space and functionality	My home has enough space for those of us who live in it	No
R7	Space and functionality	Each person in my household has a place to sleep	No
R8	Space and functionality	The kitchen in my home is comfortable for preparing food	No
R9	Space and functionality	My home lacks storage space for my belongings	Yes
R10	Space and functionality	The layout of my home facilitates daily activities	No
R11	Housing safety	The roofs of my home are in good condition	No
R12	Housing safety	I feel safe inside my home	No
R13	Home security	The doors of my home close securely	No
R14	Housing safety	The walls of my home have cracks	Yes
R15	Housing security	I feel secure that I will be able to continue living in this dwelling	No
R16	Housing services	Water is supplied to my home continuously	No
R17	Housing services	The electricity supply in my home works reliably	No
R18	Housing services	The drainage system in my home works without problems	No
R19	Housing services	There are frequent water outages in my home	Yes
R20	Housing services	My home has an internet connection	No
R21	Immediate surroundings	My street is paved	No
R22	Immediate surroundings	There is a grocery store near my home	No
R23	Immediate surroundings	My street is lit at night	No
R24	Immediate environment	I feel unsafe walking down my street at night	Yes
R25	Immediate surroundings	There is public transportation near my home	No

Note. Northwest Residential Habitability Scale (Culiacán application). Five-point response scale (Strongly disagree, Disagree, Neither agree nor disagree, Agree, Strongly agree). Reverse-scored items have already been recoded in the delivered data matrix. Source: Factoriza UAS, project FZ-HAB-0034, survey LEV-0039, dataset DST-0036.

PROCEDURE

Responses were collected through the survey questionnaire administered on Factoriza

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UAS, which records explicit online informed consent before the first item and does not collect identifying data. Factoriza froze dataset DST-0036 with a cryptographic hash, generated the matrix with reverse-scored items recoded, and produced the descriptive, internal-consistency, and within-dimension correlation analyses (runs RUN-00206 to RUN-00216). The complementary analyses were performed using the data file and the item dictionary exported from the platform.

DATA ANALYSIS

In the first stage, Factoriza UAS calculated the mean, standard deviation, skewness, kurtosis, and percentages of responses at the extreme values for each item; the internal consistency of each dimension using Cronbach's alpha (Cronbach, 1951), together with the corrected item-total correlation and alpha if item deleted; and Pearson correlations between the items of each dimension, with 95% confidence intervals obtained through Fisher's transformation.

In a second stage, the program analisis_psicometrico.py (version 1.0) was run in Python 3.13.16 (Python Software Foundation, 2026) with NumPy 2.5.3 (Harris et al., 2020), SciPy 1.18.1 (Virtanen et al., 2020), and pandas 3.0.5. The program applies fixed, stated procedures, with no manual intervention in the calculations.

The program estimated McDonald's omega total (McDonald, 1999/2013) for each dimension from a one-factor model, without reversing items; when any item correlates or loads negatively relative to the rest of its dimension, the program does not report omega because the coefficient is no longer interpretable. It also attempted an exploratory factor analysis of the twenty-five items, preceded by an assessment of overall and item-level sampling adequacy (Lorenzo-Seva and Ferrando, 2021) and by the test of sphericity. The number of factors was determined by parallel analysis, with minimum residual extraction and oblimin rotation.

Finally, it estimated the correlation between mean dimension scores with Spearman's coefficient and its 95% confidence interval, computed through the Fisher transformation using the standard error of Bonett and Wright (2000).

The reference values for interpreting the psychometric indices are treated as guidelines rather than as decision rules (Ferrando et al., 2022). No items were removed; the program flags problematic items and leaves the decision to the authors. Confirmatory factor analysis was not performed and is proposed as future work.

ETHICAL CONSIDERATIONS

Participation was voluntary and anonymous. Factoriza UAS records express informed consent online and does not collect names, email addresses or any other identifying data.

STATEMENT ON THE USE OF ARTIFICIAL INTELLIGENCE

During the preparation of this manuscript, the following tools were used: the Factoriza UAS platform, for data management and for descriptive, internal consistency and inter-item correlation analyses; a Python analysis program with fixed and validated procedures, for omega, exploratory factor analysis and inter-dimension correlations; and the Claude Opus language model (Anthropic), for running that program, assisted literature search, writing a draft and assembling the document from the results. The authors reviewed, corrected and approved the entire text, verified every reference and take full responsibility for the content of the article.

RESULTS

SAMPLE COMPOSITION

Table 2 summarizes the flow of cases. Of the 14 individuals who opened the questionnaire, 9 completed it and were analyzed, with no exclusions for quality control. Every analyzed case answered all twenty-five items.

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Table 2. Sample composition.

Indicator	Value
People who opened the questionnaire	14
Completed questionnaires	9
Cases excluded by quality control	0
Cases analyzed	9
Items	25

Note. Survey "Piloto Culiacán · Escala de habitabilidadresidencial" (Culiacán Pilot · Residential Habitability Scale) (LEV-0039); population: persons aged 18 years or older living in a dwelling in Culiacán; territory: Culiacán, Sinaloa, in neighborhoods (colonias) selected by the project lead. Dataset DST-0036, fingerprint 52b16fab6f72735e. Source: Factoriza UAS. Preliminary cutoff: n = 9 of a target of 100, with data collection still open.

DESCRIPTIVE STATISTICS

Table 3 and Figure 1 present the descriptive statistics. The highest means on the instrument corresponded to the feeling of safety inside the home (R12: *M* = 4.67, *SD* = 0.50) and to the security of being able to continue living in it (R15: *M* = 4.67, *SD* = 0.50), with 67% of responses at the maximum value in both cases. These were followed by each household member having a place to sleep (R7) and the comfort of the kitchen (R8), both with *M* = 4.56 (*SD* = 0.53).

Services also received high ratings: internet connection (R20: *M* = 4.44, *SD* = 0.53), continuity of the water supply (R16: *M* = 4.33, *SD* = 0.50), and functioning of the drainage system (R18: *M* = 4.33, *SD* = 0.50). The stability of the electricity supply (R17: *M* = 4.00, *SD* = 1.32) showed the greatest dispersion within the dimension, with marked negative skewness (-1.67).

The lowest ratings were concentrated on heat and on insecurity in the surrounding area. The recoded item on experiencing heat in summer had the lowest mean in the instrument (R5: *M* = 2.33, *SD* = 1.12), with 33% of responses at the minimum value, which corresponds to strongly agreeing with feeling hot inside the dwelling in summer. Next came feeling unsafe when walking on the street at night, also recoded (R24: *M* = 2.56, *SD* = 0.88).

Intermediate means were observed for the lack of storage space (R9 recoded: *M* = 3.44, *SD* = 1.01), the presence of cracks in the walls (R14 recoded: *M* = 3.56, *SD* = 1.13) and the entry of natural light (R3: *M* = 3.56, *SD* = 0.88). Overall, this profile describes dwellings their occupants consider safe, with sufficient space and adequate services, but hot in summer and located on streets they find unsafe at night.

Table 3. Descriptive statistics for the items.

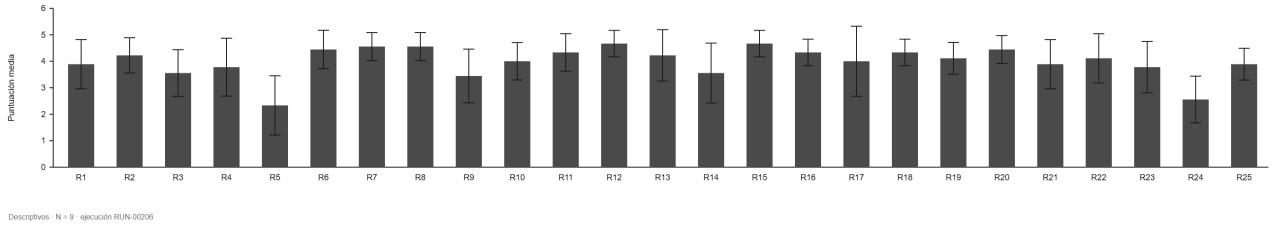
Item	M	SD	Skewness	Kurtosis	Floor	Ceiling
R1	3.89	0.93	-0.94	1.35	11%	22%
R2	4.22	0.67	-0.25	-0.04	11%	33%
R3	3.56	0.88	-0.21	0.14	11%	11%
R4	3.78	1.09	-0.19	-1.23	11%	33%
R5	2.33	1.12	-0.15	-1.49	33%	11%
R6	4.44	0.73	-1.01	0.19	11%	56%
R7	4.56	0.53	-0.27	-2.57	44%	56%
R8	4.56	0.53	-0.27	-2.57	44%	56%
R9	3.44	1.01	-0.27	-0.76	22%	11%
R10	4.00	0.71	0.00	-0.29	22%	22%
R11	4.33	0.71	-0.61	-0.29	11%	44%
R12	4.67	0.50	-0.86	-1.71	33%	67%
R13	4.22	0.97	-1.60	3.19	11%	44%
R14	3.56	1.13	-1.51	3.20	11%	11%
R15	4.67	0.50	-0.86	-1.71	33%	67%
R16	4.33	0.50	0.86	-1.71	67%	33%
R17	4.00	1.32	-1.67	2.95	11%	44%
R18	4.33	0.50	0.86	-1.71	67%	33%

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Item	M	SD	Skewness	Kurtosis	Floor	Ceiling
R19	4.11	0.60	0.02	1.13	11%	22%
R20	4.44	0.53	0.27	-2.57	56%	44%
R21	3.89	0.93	-0.94	1.35	11%	22%
R22	4.11	0.93	-1.47	3.28	11%	33%
R23	3.78	0.97	-0.50	-0.01	11%	22%
R24	2.56	0.88	-0.21	0.14	11%	11%
R25	3.89	0.60	-0.02	1.13	22%	11%

Note.N = 9. Floor and ceiling indicate the percentage of responses at the minimum and maximum values. The item-total correlation column across the twenty-five items is omitted because it combines five dimensions; the item-total correlation by dimension is presented in Table 4. Run RUN-00206 of Factoriza UAS. Preliminary cutoff: n = 9 out of a target of 100, with data collection ongoing.

Figure 1. Mean scores per item with one-standard-deviation error bars.



INTERNAL CONSISTENCY

Table 4 reports the item analysis by dimension computed with Factoriza, and Table 5 presents the coefficients from the complementary software. Three dimensions showed acceptable internal consistency at this time point: Space and Functionality (α = .800; ω = .842), Housing Safety (α = .791; ω = .850), and Housing Services (α = .748; ω = .863).

In Space and functionality, R6 was the most consistent item (.710) and R10 the least (.463), and the highest correlation was between R6 and R7 (r = .907, 95% CI [.610, .980], p < .001). In Housing safety, R12 was the most consistent (.821) and R13 the least (.461); the correlations that stood out were between R12 and R14 (r = .811, 95% CI [.318, .959], p = .008), R11 and R12 (r = .707, 95% CI [.081, .933], p = .033), and R13 and R15 (r = .686, 95% CI [.040, .928], p = .041).

In Housing services, R19 was the most consistent item (.744) and R17 the least (.476); removing R17 would raise alpha to .858. Water continuity (R16) and drainage function (R18) received exactly the same responses in all nine cases, so their correlation was 1.000 and Factoriza reports a degenerate interval for it. Both correlated with internet connection (R20: r = .791, 95% CI [.266, .954], p = .011), and electricity stability correlated with water outages (R17 and R19: r = .786, 95% CI [.255, .953], p = .012).

The other two dimensions did not behave as scales in this round. Housing comfort obtained α = .490; omega is not reported because R3, natural light, correlated negatively with the rest of the dimension (-.060) and R4, air circulation, had the opposite sign in the one-factor model. Removing R3 would raise alpha to .613. The clearest correlation within the dimension was between pleasant temperature and the absence of heat in summer (R1 and R5: r = .763, 95% CI [.201, .947], p = .017).

Immediate Environment had α = .288; omega is not reported because R21 (paving) and R25 (public transport) had the opposite sign to the remaining items. R22, the nearby store, was the most consistent item (.604), whereas R25 correlated negatively with the dimension (-.242) and R24, nighttime insecurity, had a virtually zero correlation (.047). None of the correlations among the Immediate Environment items had a confidence interval that excluded zero.

Table 4. Item analysis by dimension.

Dimension	Item	Corrected item-total r	α if item deleted
Comfort	R1	.495	.273
Comfort	R2	.381	.391
Comfort	R3	-.060	.613
Comfort	R4	.515	.222

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Dimension	Item	Corrected item-total r	α if item deleted
Comfort	R5	.127	.543
Space	R6	.710	.720
Space	R7	.700	.744
Space	R8	.700	.744
Space	R9	.539	.809
Space	R10	.463	.797
Security	R11	.537	.763
Security	R12	.821	.718
Safety	R13	.461	.800
Security	R14	.665	.739
Security	R15	.709	.741
Services	R16	.563	.706
Services	R17	.476	.858
Services	R18	.563	.706
Services	R19	.744	.640
Services	R20	.717	.663
Environment	R21	.093	.286
Environment	R22	.604	-.329
Environment	R23	.205	.169
Environment	R24	.047	.324
Environment	R25	-.242	.459

Note.N = 9. Scale from 1 to 5; reverse-scored items R5, R9, R14, R19, and R24 are shown recoded. Run RUN-00206 of Factoriza UAS. Preliminary cutoff: n = 9 of a target of 100, with data collection still open.

Table 5. Internal consistency by dimension.

Dimension	Items	n	α	ω	Remarks
Housing comfort	5	9	.490		Reverse-worded items: R3, R4; ω not interpretable
Space and functionality	5	9	.800	.842	
Housing security	5	9	.791	.850	
Housing services	5	9	.748	.863	
Immediate surroundings	5	9	.288		Reverse-keyed items: R21, R25; ω not interpretable

Note.N = 9. Comfort = Housing comfort; Space = Space and functionality; Safety = Housing safety; Services = Housing services; Surroundings = Immediate surroundings. The corrected item-total correlation excludes the item itself from the total of its dimension. Cronbach's α for the complete dimension, with 5 items each: Comfort = .490 (run RUN-00207); Space = .800 (RUN-00209); Safety = .791 (RUN-00211); Services = .748 (RUN-00213); Surroundings = .288 (RUN-00215). Source: Factoriza UAS, Tables 4, 6, 8, 10, and 12 of the package, combined without modifying values. Preliminary cutoff: n = 9 out of a target of 100, with data collection still open.

INTERNAL STRUCTURE

The planned exploratory factor analysis could not be estimated in an interpretable way, and its results are not presented in tables. With 9 cases and 25 items, the correlation matrix is not invertible; consequently, the measure of sampling adequacy could not be computed, and the test of sphericity returned an uninterpretable value. Parallel analysis suggested one factor, which explained 40.24% of the variance in the software's solution, with insufficient loadings on R21, R24 and R25; however, with fewer cases than items, this solution is unsupported. These results are reported in the reproducibility appendix, but they provide no evidence regarding the dimensionality of the instrument and should not be cited as such.

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RELATIONSHIP BETWEEN THE DIMENSIONS

Table 6 presents the Spearman correlations between the mean scores of the five dimensions, based on 9 cases. The four housing-related dimensions were highly and positively correlated with one another, and their intervals excluded zero. The highest correlation was that of Space and Functionality with Housing Services, ρ = .931, 95% CI [.609, .990], p < .001, followed by those of Housing Comfort with Space and Functionality (ρ = .861, 95% CI [.345, .977]), with Services (ρ = .852, 95% CI [.318, .976]), and with Safety (ρ = .841, 95% CI [.284, .973]).

In contrast, none of the correlations involving Immediate surroundings had an interval that excluded zero. For Space and functionality with Immediate surroundings (ρ = .707, 95% CI [-.014, .944]), the p value was less than .05, but the more conservative Bonett and Wright interval included zero, so this relationship is not considered established.

Table 6. Correlationsbetweendimensions.

Dimension pair	n	ρ	IC 95 %	p
Housing comfort and Space and functionality	9	.861	[.345, .977]	.003
Housing Comfort and Housing Security	9	.841	[.284, .973]	.005
Housing Comfort and Housing Services	9	.852	[.318, .976]	.004
Housing Comfort and Immediate Surroundings	9	.609	[-.163, .918]	.082
Space and functionality and Housing safety	9	.769	[.107, .959]	.015
Space and functionality and Housing services	9	.931	[.609, .990]	< .001
Space and functionality and Immediate environment	9	.707	[-.014, .944]	.033
Housing safety and Housing services	9	.803	[.186, .966]	.009
Housing Safety and Immediate Surroundings	9	.402	[-.385, .850]	.284
Housing Services and Immediate Surroundings	9	.586	[-.192, .912]	.097

Note.α = Cronbach's alpha; ω = McDonald's omega total based on a one-factor minimum residual model, without reversing items. Complete cases per dimension. Source: Own calculations using analisis_psicometrico.py 1.0 (Python 3.13.16), dataset DST-0036_FZ_HAB_0034. Preliminary cutoff: n = 9 out of a target of 100, with data collection ongoing.

DISCUSSION OF RESULTS

The purpose of this study was to describe the initial performance of the Northwest Residential Habitability Scale as applied in Culiacán. The central finding is uneven across dimensions. Space and Functionality, Housing Safety, and Housing Services showed acceptable internal consistency, whereas Housing Comfort and Immediate Surroundings did not behave as scales.

With only 9 cases, all coefficients are provisional: the simulation literature on the alpha and omega coefficients is based on much larger samples (Malkewitz et al., 2023), and the internal structure could not be estimated.

The descriptive profile is consistent with the regional literature. The low rating for summer comfort matches the description of social housing in Culiacán as very hot (Barraza-Bracamontes et al., 2022) and the evidence of unfavorable thermal and energy performance of social housing in northwestern Mexico (Muñoz López et al., 2023).

The high ratings for safety within the dwelling, for sleeping space, and for services suggest that, in this cross-section, deficiencies are concentrated in thermal comfort and the surrounding environment rather than in the housing unit itself. These correspondences are descriptive: the study did not measure indoor temperature or the physical conditions of the dwellings.

The low consistency of Housing Comfort may have a content-related explanation. The dimension combines thermal, acoustic, lighting and ventilation aspects that do not necessarily vary together: a dwelling may receive a great deal of natural light while also being hot, because the solar radiation that illuminates it also heats it.

The negative correlation between natural light and the absence of heat in summer, although not conclusive, points in that direction. Immediate Surroundings, for its part, brings together street infrastructure, access to shops and transport, and perceived safety, aspects that may be distributed independently across neighborhoods. Both dimensions might require revising their composition or splitting them into facets.

The very high correlations among the four housing-related dimensions warrant cautious interpretation. They may indicate an overall assessment of habitability that people apply to all

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aspects of their dwelling, consistent with the multidimensional yet integrated view of residential satisfaction (Alaie et al., 2022; Saleem and Alchalabi, 2025) and with the positive association among the subdimensions of perceived residential environment quality (Zhao et al., 2025).

They may also reflect general differences between cases that the questionnaire did not record, such as housing type or socioeconomic status, or a response style. With 9 cases, these explanations cannot be told apart, and confirming that the dimensions are distinct will require factor analysis of the final sample.

The reverse-scored items showed no general problematic pattern: R9, R14 and R19 had positive, moderate-to-high item-total correlations, and R5 correlated with pleasant temperature. The exception was R24, feeling unsafe at night, which had a near-zero correlation with its dimension.

Scales with items keyed in both directions require careful interpretation (Steinmann et al., 2022), but for R24 the most likely explanation lies in the item's content: feeling unsafe when walking at night depends on social conditions that do not necessarily coincide with street infrastructure. The exact match between R16 and R18, meanwhile, should be reviewed before the final analysis, because in small samples poorly differentiated response patterns can distort the correlations (Ward and Meade, 2023).

CONCLUSIONS

The study achieved its objective to the extent permitted by a preliminary data cut of 9 cases. When applied in Culiacán, the Northwest Residential Habitability Scale showed acceptable internal consistency for Space and Functionality (α = .800; ω = .842), Housing Safety (α = .791; ω = .850), and Housing Services (α = .748; ω = .863), and low internal consistency for Housing Comfort (α = .490) and Immediate Surroundings (α = .288).

Exploratory factor analysis could not be estimated interpretably because the sample has fewer cases than items, and the four housing-related dimensions were highly intercorrelated. The results do not yet provide evidence of structural validity, but they describe dwellings rated as safe, with adequate space and services, yet hot in summer and located in surroundings perceived as unsafe at night.

The limitations are substantial. The sample of 9 cases (against a target of 100), with 0.4 cases per item, precludes estimation of the internal structure and makes all statistics unstable; data collection was still ongoing, and not everyone who opened the questionnaire completed it.

The neighborhoods (colonias) were selected by the project leader, and no information is available on the respondents, housing tenure or dwelling type. The study did not measure the physical conditions of the dwellings, and its results refer only to perception. The cross-sectional design precludes establishing dependence relationships, and no confirmatory factor analysis was performed.

These results lead to several decisions for the authors. The first is to review the composition of Housing comfort, particularly the role of R3 and R4, and to assess whether thermal comfort should be separated from the other aspects. The second is to review Immediate surroundings, whose infrastructure, access and safety items did not behave as a scale.

The third is to verify the agreement between the responses to R16 and R18. The fourth is to record housing tenure and dwelling type, the number of occupants, and the administration period. The fifth is to clarify the relationship between this instrument and the scale of project FZ-HAB-0024. None of these decisions was made in the present analysis, which retains the original twenty-five items.

For future work, we propose completing data collection to the planned target, repeating the exploratory factor analysis once the number of cases allows, and then evaluating the resulting structure through confirmatory factor analysis in an independent sample.

If the scale is administered in other cities in northwestern Mexico, each survey should be analyzed as an independent sample before any comparison between cities. An instrument with documented validity evidence would make it possible to monitor housing habitability in Culiacán and to steer housing policy toward the aspects, such as thermal comfort, that residents rate less favorably, in line with the critical assessment of social housing policy in Mexico (Hernández Ilizaliturri et al., 2025).

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