TPM®

DEVELOPMENT AND VALIDATION OF THE PERCEPTION OF HOUSING QUALITY SCALE (PHQS)

FEDERICA CAFFARO
DARIO GALATI
MICHELE ROCCATO
UNIVERSITY OF TORINO

In this study, we aimed to develop and validate the Perception of Housing Quality Scale (PHQS), a multi-item, multi-factorial measure of perceived housing quality focused on people's homes as the unit of analysis and based on individuals' perceptions of how much the physical aspects of their home environments fulfill their daily needs. The instrument was developed by a multidisciplinary team comprising psychologists and architects for the identification of the main factors describing the perceived quality of the physical features of home environments. Confirmatory factor analysis performed on the data, collected from a quota sample comprising 285 Italian adults aged between 25 and 65 (women = 52.3%, M_{age} = 42.81, *SD* = 12.73), confirmed the hypothesis that two correlated factors define perceived housing quality: "Indoor environment and architectural design" and "Outdoor stressors." These factors revealed the expected correlations with home ownership and the discrepancy between the actual and the ideal home. The implications of this scale in housing research are discussed.

Key words: Housing; Indoor environment; Measurement; Perception of housing quality; Quality of life.

Correspondence concerning this article should be addressed to Federica Caffaro, Department of Psychology, University of Torino, Via Verdi 10, 10124 Torino, Italy. Email: federica.caffaro@gmail.com

The relationship between individuals and their environment is one of the most relevant issues in environmental psychology research (Baroni & Berto, 2013; Bechtel & Churchman, 2002; Bonnes, Lee, & Bonaiuto, 2003; Bonnes & Secchiaroli, 1995; Stokols & Altman, 1987) and a key factor in defining people's mood, health, and quality of life (QoL) (Evans & Cohen, 2004; Evans & McCoy, 1998; Gifford, 2002; Marans, 2003). The World Health Organization Group (1994) defines QoL as "individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns" (p. 28), highlighting the subjective nature of the concept, which cannot be measured solely by objective indicators based on one's economic, social, or health status. QoL comprises four different domains (World Health Organization Group, 1998): physical, psychological, relational, and environmental. The environmental domain has been proven to be as important as the other three in defining overall QoL (Power, Harper, & Bullinger, 1999).

In addition to QoL, the quality of one's environment can be assessed from two different perspectives (Gifford, 2002): expert versus lay. The expert's assessment is often defined as being objective because it involves physical measures by means of technological instruments or objectively quantifiable indexes. The layperson's assessment is considered to be subjective because it is

based on self-reporting tools with which a person expresses his/her own perceptions, observations and impressions, and thus it offers a measurement of experienced environmental quality.

In the environmental psychology literature, individuals' evaluation of the environment has been mainly measured in terms of perceived environmental quality indicators (PEQIs; Carp & Carp, 1982; Christensen & Carp, 1987; Craik & Zube, 1976), and it has been investigated in many different settings, especially in the workplace and in healthcare settings (for a review, Rashid & Zimring, 2008). In healthcare, it is assessed to get the basis for improving patients' health and feelings (Fornara, Bonaiuto, & Bonnes, 2006; Ulrich, Zimring, Joseph, Quan, & Choudhary, 2004), while in the workplace, it is investigated because of its effects on both job performance and job satisfaction (Bellini, Fornara, & Bonaiuto, 2015; Hwang & Kim, 2011; Leather, Beale, & Sullivan, 2003; Vischer, 2007).

With regard to the residential environment, different instruments have been developed to measure residents' appraisal of both specific and general aspects of residential quality, such as the perceived residential quality indicators (PRQIs; Amérigo & Aragones, 1990, 1997; Aragones & Corraliza, 1992) and the perceived residential environment quality indicators (PREQIs; Bonaiuto, Aiello, Perugini, Bonnes, & Ercolani, 1999; Bonaiuto, Fornara, & Bonnes, 2003). Through these instruments, perceived residential quality has been investigated at the home, neighborhood, and city levels. Many studies focus particularly on the neighborhood, as it is considered an intermediate level of analysis between the processes of the private (home level) and the public (city level) spheres (Bonaiuto & Bonnes, 1996). At this level, three main evaluative aspects of residential quality have emerged (Amérigo, 2002; Canter, 1983): spatial (i.e., architectural and urban planning), human (i.e., people and social relationships), and functional (i.e., services and facilities). A further dimension regarding context features (concerning neighborhood lifestyle, environmental health/pollution and upkeep/care) was detected by Bonnes, Bonaiuto, Aiello, Perugini, and Ercolani (1997).

In the present study, the territorial unit of analysis taken into account was the home. We chose to do so because this is one of the most salient environments in individuals' lives, as people spend most of their everyday lives and perform many of their activities in their home (European Commission, 2004; World Health Organization Regional Office for Europe, 2007). Different studies have reported that the home is one of the pivotal components of happiness and life satisfaction (Felce, 1997; Galati, Manzano, & Sotgiu, 2006; Galati, Sotgiu, & Iovino, 2006; Larson, 1978; Michalos, 1980, 1982, 1983; Shin & Johnson, 1978; van Praag, Frijters, & Ferrer-i-Carbonell, 2003), and the home environment is also one of the main facets included in the environmental domain of QoL (World Health Organization Group, 1998). There is also empirical evidence that the perceived quality of the physical features of people's home environments contributes to their everyday QoL (Ariffin, Zahari, & Nadarajah, 2010; Bonnefoy, Braubach, Moissonnier, Monolbaev, & Röbbel, 2003), and some variables have been noted as affecting the perception of housing quality. First, Elsinga and Hoekstra (2005) reported that being a homeowner improves one's evaluation of housing quality, which is an important determinant of housing satisfaction. Second, researchers into the "actual-aspirational gap" approach (Galster, 1987; Galster & Hesser, 1981; Michalos, 1985) have shown that a high discrepancy between the actual and the ideal home lowers the perceived housing quality and therefore residential satisfaction. Third, the role played by the "residential quality pattern" has been highlighted by Amérigo and Aragones (1997) in their study of residential satisfaction; they defined it "a normative element whereby the individual compares his/her real and ideal residential environments" (p. 48).

At present, however, perceived housing quality is rarely investigated per se. There have been some investigations on this issue, but they have not given rise to a consistent body of research on this topic. The home environment has mainly been considered within wider studies about residential satisfaction, together with neighbors and neighborhood (Amérigo & Aragones, 1997; Canter & Rees, 1982; Fornara, Bonaiuto, & Bonnes, 2010) but without a specific focus on this micro level of analysis. Consistent with this, the questionnaires typically used in these types of research include items about the home environment in scales measuring neighborhood satisfaction as a whole (Adriaanse, 2007; Bonnes et al., 1997; Christakopoulou, Dawson, & Gari, 2001; Fornara et al., 2010) and do not use items specifically aimed at assessing residents' perceived housing quality. Moreover, in these questionnaires, there is not a shared vision of which aspects of the home should be considered to adequately investigate this construct (i.e., there is not a recurrent and strengthened set of critical indicators to use when evaluating the perceived quality of the home environment). Furthermore, the unit of analysis is not always the same, going from the house as a whole to specific rooms (Adriaanse, 2007; Amérigo & Argones, 1990, 1997; Grzeskowiak, Sirgy, Lee, & Claiborne, 2006; Lu, 1999). Finally, from the methodological point of view, the existing scales are plausibly lacking in reliability (Schuman & Presser, 1981), in that, as Evans (2003) noticed, they often use dichotomous items that register the presence or absence of the particular element without asking participants to graduate their responses (e.g., Elsinga & Hoekstra, 2005; Galster, 1987). Thus, as a whole, at present, a standard, psychometrically sound questionnaire to assess perceived housing quality, allowing researchers to compare results gained in different studies, does not exist.

Aims and Hypotheses

Based on the above considerations, in this study we aimed to develop and validate a new scale, the Perception of Housing Quality Scale (PHQS), a bidimensional, multi-item measure of perceived housing quality focused on people's homes as the only unit of analysis and based on individuals' perceptions of how much the physical aspects of their home environment, answering to their daily needs, improve their QoL. The instrument was developed by our psychological team in collaboration with architects who are experts in building physics and indoor environmental quality, so that it can be useful for both research aims on housing quality and applications in residential buildings' evaluation and renovation.

For the development of the PHQS, we started by analyzing the literature from environmental psychology focused on PEQIs and PREQIs, singling out all the possible relevant aspects for defining perceived housing quality. Two recurrent categories of items emerged from the literature: those referring to residential environment attributes (i.e., house spaciousness, layout, and maintenance: see Amérigo & Aragones, 1990; Galster, 1987; Grzeskowiak et al., 2006; Mohit, Ibrahim, & Rashid, 2010; Oswald, Schilling, Wahl, Fänge, Sixsmith, & Iwarsson, 2006; Winston & Eastaway, 2008) and those concerning environmental stressors (i.e., noise, air quality, and lighting: see Baroni & Berto, 2013; Evans, 2003; Evans & Cohen, 2004). However, in the literature, these two categories present a certain degree of overlap. Indeed, some aspects are occasionally treated as indicators of a certain category and at other times occur as indicators of the other or even as indicators of both categories. For example, "cold" is typically investigated in relation to residential infrastructures (e.g., Amérigo & Aragones, 1990), but sometimes it is considered as a stressor (Evans & Cohen, 2004).

Thus, based on our discussion with a group of architects who are experts in this domain and on the architectural literature about indoor comfort (e.g., Race, 2006), our next step was to better specify these categories and to highlight the core elements of perceived housing quality (i.e., its most typical and relevant aspects). We used the frequency of the occurrence of each aspect and its salience in both the psychological and the architectural literature as parameters within each category. At the end of this procedure, we identified 14 items related to the following: apartment position within the building, floor area, rooms layout, natural lighting, artificial lighting, ventilation, exposure, summer and winter indoor microclimate, maintenance, accessibility, outdoor air quality, noise from adjacent houses/apartments, and noise from the street. Each item was scored on a 1-7 scale (*not at all functional-extremely functional*), and each participant had to evaluate how much each environmental aspect was functional in terms of the needs of his/her everyday life at home.

Based on the procedure of category specification described above, we expected the first 11 items, which referred to the physical structural aspects of the house, to load on a first factor, "Indoor environment and architectural design," and the other three, which referred to stressors coming from the outdoor environment, to load on a second factor, "Outdoor stressors." Based on Rashid and Zimring (2008), we expected a strong positive correlation between our two factors. Table 1 shows the expected structure of the scale.

To test the validity of the PHQS, we followed a two-step procedure. First, we performed a confirmatory factor analysis aimed at explicitly testing the factorial structure of the scale. Second, we tested its construct validity by analyzing its correlations with two variables that, according to the literature, should show significant relations with residential satisfaction. Based on Elsinga and Hoekstra (2005), we expected that home ownership would show a positive correlation with people's perception of housing quality (H1). Moreover, based on Galster (1987; see also Galster & Hesser, 1981; Michalos, 1985), we expected that the discrepancy between the actual and the ideal home would show a negative correlation with such a perception (H2).

METHOD

Participants and Procedure

Two-hundred eighty-five Italian adults aged between 25 and 65 (women = 52.3%, M_{age} = 42.81, *SD* = 12.73) were recruited by means of quota sampling with respect to gender (for the distribution of the Italian population as concerns gender, see Istat, 2011). All of our participants lived in Turin, a city in Piedmont, in the North-Western Italy. Almost half of the participants had a high school diploma (42.1%), while 29.9% had a university degree. Over half of the sample was married (53.3%; single = 32.3%; living with the partner = 10.2; divorced = 2.8%; widow = 1.4%). With regard to the area of residence within the city, 35.1% lived in the city center and 64.9% in the suburbs. Regarding homeownership, the majority was represented by owners (82.8%; rent = 17.2%). The mean length of residence in the present dwelling was 15.95 years (*SD* = 11.51), and the mean number of hours spent at home during weekdays and holidays was 13.24 (*SD* = 3.73) and 15.56 (*SD* = 4.99), respectively.

TABLE 1
Perception of Housing Quality Scale (PHQS) items and their expected factorial structure of the scale

	Item	Factor 1: Indoor environment and architectural design	Factor 2: Outdoor stressors
1	Think about your apartment position within the building and rate it, with regard to your daily needs[a]	**	
2	Think about your rooms' area and rate it, with regard to your daily needs	**	
3	Think about your rooms' layout and rate it, with regard to your daily needs	**	
4	Think about natural lighting in your home and rate it, with regard to your daily needs	**	
5	Think about artificial lighting in your home and rate it, with regard to your daily needs	**	
6	Think about ventilation in your home and rate it, with regard to your daily needs	**	
7	Think about outdoor air quality and rate it, with regard to your daily needs		**
8	Think about noise coming from adjacent houses/ apartments and rate it, with regard to your daily needs		**
9	Think about noise coming from the street and rate it, with regard to your daily needs		**
10	Think about your home exposure and rate it, with regard to your daily needs	**	
11	Think about summer microclimate in your home and rate it, with regard to your daily needs	**	
12	Think about winter microclimate in your home and rate it, with regard to your daily needs	**	
13	Think about your home maintenance and rate it, with regard to your daily needs	**	
14	Think about your home accessibility and rate it, with regard to your daily needs	**	

Note. [a]Only for participants living in an apartment. Items are listed in the same order they were presented to the participants.

The participants were administered a 29-item questionnaire comprising two different sections. The first section referred to their actual housing situation: it included the 14 items of the PHQS, four items concerning the objective features of the dwelling (type of dwelling, floor area, space layout, and number of rooms), and six items concerning the residential experience (area of residence within Turin, household size, home ownership, length of residence in the dwelling, and hours spent at home during weekdays and holidays). The second section referred to participants' ideal housing situation and comprised four items concerning the objective features of the ideal home (type of dwelling, floor area, space layout, and number of rooms), plus one item concerning

participants' household size. Then, participants were administered a sociodemographic form to collect information about their gender, age, education, and marital status.

Participants were recruited by the first author using a snowball procedure. They completed the questionnaire at their own homes after signing an informed consent. After their participation, they were debriefed.

Data Analysis

We tested the factorial validity of our scale via a series of confirmatory factor analyses (extraction: MLR, adequate in the case of violation of the normality of the distribution of the items) using Mplus7 (Muthén & Muthén, 1998). First, we tested the fit of the unidimensional model for a comparison with that of the two-factor model we hypothesized. Subsequently, after verifying the solidness of the two-factor model, based on the modification indexes given by the software, we proceeded to improve our model by performing modifications that were reasonable both from the methodological and the theoretical points of view (thus, even when suggested, we never correlated the errors of two or more items). For each model we tested, we proceeded as suggested by Arbuckle (2007). First, we analyzed the model's fit. In the case of an unsatisfactory solution, we analyzed the modification indices provided by the software and deleted the most problematic items. Then, we tested the new model and reiterated the procedure until we obtained a fully satisfactory model.

Based on Hu and Bentler (1998) and Primi (2002), we evaluated the fit of our models by combining different indexes: the comparative fit index (CFI), the Tucker-Lewis index (TLI), and the root mean square error of approximation (RMSEA). We considered the CFI and the TLI to be satisfactory if higher than .90 and RMSEA if lower than .08, as suggested by Bentler (1990) and Browne (1990), respectively. Even if reported, based on Jöreskog and Sörbom (1996), we chose not to consider the χ^2 of the models we tested because the significance of this fit index depends on the number of cases.

Subsequently, to test the construct validity of the scale, we tested H1 and H2 by examining the relations between the PHQS scores and home ownership on the one hand, and between the PHQS scores and the discrepancy between actual and ideal home on the other. To test H1, the answers to the item referring to homeownership were coded 0 if living in a rented home and 1 if living in one's own home. To test H2, we computed the discrepancy index between participants' actual home and their ideal housing situation by adding together the differences (1 = *actual housing situation different from the ideal one*; 0 = *actual housing situation equal to the ideal one*) in responses to items about actual and ideal housing conditions.

RESULTS

Table 2 reports the descriptive statistics for the items we developed. Table 3 reports the fit indexes of the models we tested and the changes we made passing from one model to the other. As expected, the model significantly improved in moving from the original unidimensional structure to the bidimensional structure we hypothesized, $\Delta(\chi^2)(1) = 26.11$, $p < .001$. However,

the fit of such a model was not completely satisfactory. Nonetheless, the fit of the bidimensional model gradually improved when, as suggested by the modification indices provided by Mplus, we deleted the first, fourth, and fifth item of the questionnaire. The fit of the resulting 11-item questionnaire was completely satisfactory. Figure 1 shows model's standardized parameters (all of the parameters were significant with $p < .001$). The final version of the Perception of Housing Quality Scale (PHQS) thus comprises 11 items: eight measuring "Indoor environment and architectural design" and three measuring "Outdoor stressors." Figure 2 shows the distribution of the scores of the two factors.

TABLE 2
Descriptive statistics for the items we used

	Item	*M*	*SD*	Skewness	*SE*	Kurtosis	*SE*
1	Think about your apartment position within the building and rate it, with regard to your daily needs[a]	5.58	1.27	–1.01	0.14	1.04	0.29
2	Think about your rooms' area and rate it, with regard to your daily needs	5.40	1.33	–.76	0.14	.09	0.29
3	Think about your rooms' layout and rate it, with regard to your daily needs	5.53	1.24	–.84	0.14	.63	0.29
4	Think about natural lighting in your home and rate it, with regard to your daily needs	5.87	1.11	–.99	0.14	1.05	0.29
5	Think about artificial lighting in your home and rate it, with regard to your daily needs	5.65	1.04	–.59	0.14	–.11	0.29
6	Think about ventilation in your home and rate it, with regard to your daily needs	6.14	1.06	–1.46	0.14	2.23	0.29
7	Think about outdoor air quality and rate it, with regard to your daily needs	5.03	1.75	.64	0.14	–.63	0.29
8	Think about noise coming from adjacent houses/apartments and rate it, with regard to your daily needs	5.33	1.63	.90	0.14	–.10	0.29
9	Think about noise coming from the street and rate it, with regard to your daily needs	4.97	1.83	.71	0.14	–.53	0.29
10	Think about your home exposure and rate it, with regard to your daily needs	5.71	1.25	1.13	0.14	1.37	0.29
11	Think about summer microclimate in your home and rate it, with regard to your daily needs	5.08	1.49	.82	0.14	.24	0.29
12	Think about winter microclimate in your home and rate it, with regard to your daily needs	5.29	1.29	.83	0.14	.52	0.29
13	Think about your home maintenance and rate it, with regard to your daily needs	5.56	1.22	1.07	0.14	1.48	0.29
14	Think about your home accessibility and rate it, with regard to your daily needs	5.58	1.26	1.04	0.14	1.00	0.29

Note. [a]Only for participants living in an apartment. Items are listed in the same order they were presented to the participants.

TABLE 3
Reliability fit indexes of the models we tested

	$\Delta^2(df)$ p	CFI	TLI	RMSEA 90% CI	Change relative to the preceding model
Model 1 (unidimensional)	(77) = 266.991 < .001	.733	.685	.093 [.081, .105]	—
Model 2 (bidimensional)	(76) = 240.881 < .001	.823	.748	.087 [.075, .100]	Two-factor structure
Model 3 (bidimensional)	(77) = 196.345 < .001	.834	.798	.075 [.062, .087]	Added correlation between the two factors
Model 4 (bidimensional)	(64) = 160.820 < .001	.853	.821	.073 [.059, .087]	Deleted Item 1
Model 5 (bidimensional)	(53) = 135.086 < .001	.868	.836	.074 [.058, .089]	Deleted Item 5
Model 6 (bidimensional)	(43) = 88.335 = .001	.916	.900	.061 [.043, .079]	Deleted Item 4

Note. CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation, CI = confidence interval.

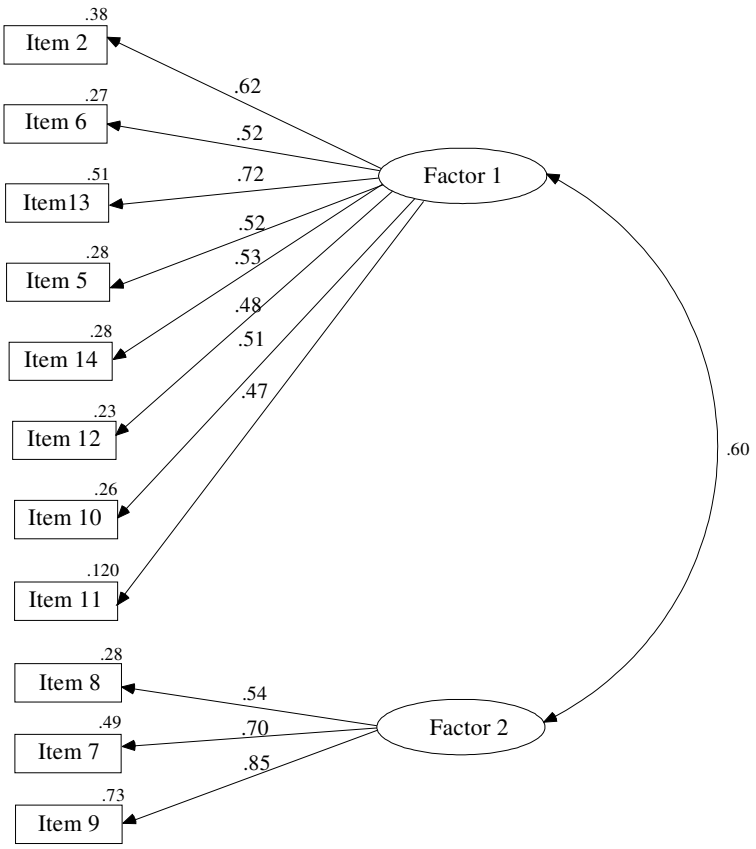
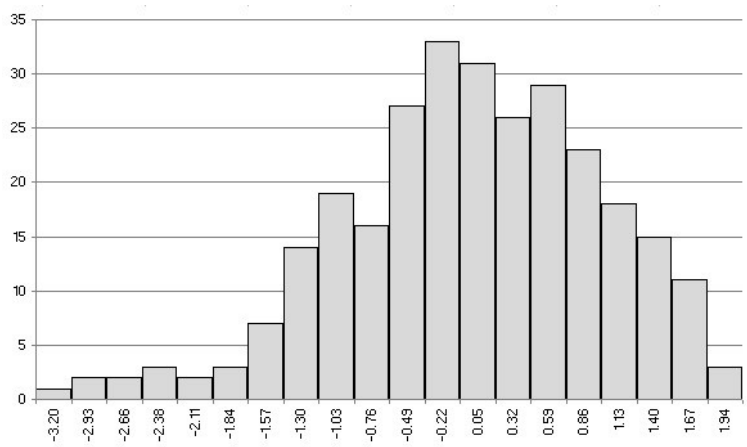


FIGURE 1
Factorial structure of the Perception of Housing Quality Scale (PHQS).
Standardized parameters are displayed.

Factor 1: Indoor environment and architectural design



Factor 2: Outdoor stressors

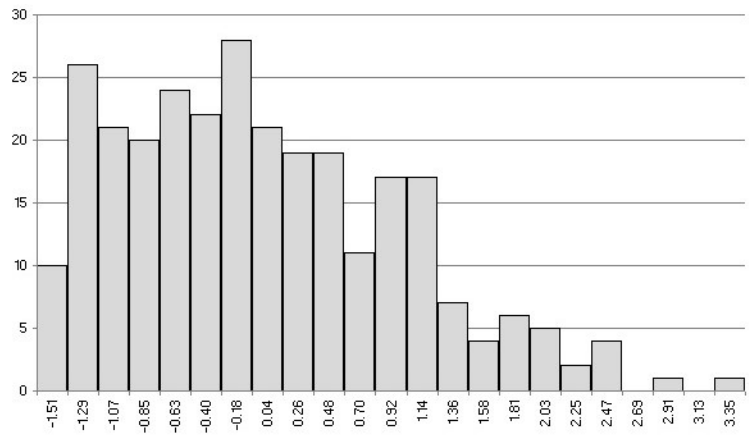


FIGURE 2
Distributions of the scores of the two factors.

The two factors showed a positive, strong and significant correlation, $r = .60$. A multiple regression showed that gender and age did not show significant associations with the first factor, $b = .01$, $SE = 0.01$, $p = .089$, and $b = –.06$, $SE = 0.12$, $p = .610$, respectively, Adjusted $R^2 = .00$, while being gendered male, $b = –.27$, $SE = 0.12$, $p = .022$, but not age, $b = .01$, $SE = 0.01$, $p = .087$, showed a weak, negative association with the second factor, Adjusted $R^2 = .02$. More interestingly as concerns our goals, consistent with H1, the PHQS scores of the participants living in a home they owned ($M = –.29$, $SD = 1.00$) were higher than those of participants living in a rented home ($M = .09$, $SD = 0.83$), $t(283) = –3.185$, $p = .002$. Moreover, consistent with H2, the perceived discrepancy between the actual and the ideal home showed a negative association with the PHSQ scores, $b = –.17$, $SE = 0.05$, $p < .001$, Adjusted $R^2 = .04$. Thus, we concluded that the PHQS passed the construct validity tests it underwent.

Discussion

The environmental psychology literature offers much empirical evidence on the importance of the subjective evaluation of the environment to assess and improve individuals' QoL (Evans & Cohen, 2004; Evans & McCoy, 1998; Gifford, 2002). Nonetheless, just few studies addressed the home environment, even if it is one of the most salient settings in people's lives. Based on these considerations, in this study, we aimed to develop and validate the Perception of Housing Quality Scale (PHQS), a measure of perceived housing quality focused on people's perceptions of how much the physical aspects of their home environment answer to their daily needs.

Our confirmatory factor analyses confirmed the expected bifactorial structure of the scale, which measured two correlated, even though conceptually and statistically distinct, factors labeled "Indoor environment and architectural design" (measured by 11 items) and "Outdoor stressors" (measured by three items). These two factors showed the expected correlations with home ownership and the discrepancy between participants' actual and ideal home, witnessing the construct validity of the PHSQ.

A comment on the structure of the PHQS should be made. As stated above, in its present version, the scale comprises two factors, the first measured by 11 and the second by three items. These items were developed based on a theoretically driven approach, which merged a psychological and an architectonical expertise. This, together with the satisfactory empirical results we gained on the PHQS construct validity, reassures us of the soundness of the scale. However, future work aimed at developing new items for measuring Factor 2 could be interesting. In this new step, it could be promising to resort to the Rasch (1960) measurement model. Although not fully widespread in psychological and social research (however, for a recent exception, see Roccato, Rosato, Mosso, & Russo, 2014), this approach is particularly promising for researchers who aim to add new items to existing scales.

Our paper has some strong points. First, our co-operation with a team of architects led us to develop the first questionnaire focused on measuring perceived housing quality. The resulting scale is sound, short, valid, and easy to administer to samples from the general population. Moreover, it may be used by both psychologists and architects in studies on housing quality performed in ecological settings. This is granted by our choice to develop our scale resorting to a quota sample from the general population. This is definitely a positive attribute of our research, in that it allowed us to overcome the "student sample bias" (Meloen, 1993), according to which psychological research is systematically performed among participants who are younger, more easily influenced, and more culturally and economically advantaged than the general population (Joe, Jones, & Ryder, 1977; Sears, 1986).

However, three limitations of our study should be acknowledged. First, contrary to stratified sampling, quota sampling — even if it is the most widely used in research performed on samples from the general population (Alreck & Settle, 1995) — does not allow for generalization from a sample to the population, as the participants are not randomly chosen. Second, all of our participants were recruited from a single town. Thus, no information about the generalizability of our results to samples from different contexts is available. Third, the *N* of our study was relatively small. Indeed, our sample comprised fewer than 300 individuals. However, it should be noted that, even if this is not a very large sample size, similar samples have been involved in the validation of PREQIs scales in previous studies. For instance, in the study by Bonaiuto et al.

(2003), 312 residents in Rome were selected to confirm the structure and number of items of the PREQ scales with respect to previous versions, whereas the works by Bonaiuto, Fornara, Ariccio, Cancellieri, and Rahimi (2015) and by Mao, Fornara, Manca, Bonnes, and Bonaiuto (2015) involved 239 Tabriz inhabitants and 340 residents of Chongqing to perform a cross-cultural validation of the PREQIs across Iran and China. In spite of these limitations, however, the PHQS showed the expected factorial structure and easily passed the tests we performed to evaluate its construct validity. Nevertheless, new research performed on larger, stratified samples extracted from different contexts would be interesting.

Finally, we would like to note that, according to some researchers of perceived service quality (e.g., Parasuraman, Zeithaml, & Berry, 1994), an evaluative scale should weight each aspect of the analyzed object by the subjective importance it has in the participant's opinion. At present, the PHQS does not allow for the weighting of each aspect with regard to its perceived *importance* in defining housing quality. We preferred not to duplicate our items for two reasons. On the one hand, we wanted to build an easy-to-respond questionnaire, easily usable in surveys of the general population without risking triggering response-sets from the participants. On the other hand, according to the literature on perceived service quality, the results from weighted and not-weighted data systematically show very strong correlations (de Carvalho & Leite, 1999). However, a new version of the PHQS, allowing the researcher to weight the subjective importance of each aspect analyzed by the scale, could be easily developed and tested in future research.

CONCLUSION

Overall, the PHQS proved to be a valid measure of the perceived quality of the physical features of a home environment, and it provided a home-level, multi-factorial perspective often neglected in research. Thanks to its ease of administration and its unobtrusive character, the PHQS will provide support for tracking the condition of houses in different neighborhoods and will help to identify critical elements undermining inhabitants' well-being.

Given the increased emphasis on housing quality across a number of social issues (United Nations Human Settlements Programme, 1996, 2010), the availability of a valid tool will plausibly provide consistency in measurement and strengthen housing research. In particular, administered together with objective evaluations of physical house characteristics (e.g., illuminance, noise level), the PHQS will allow researchers to highlight consistencies and discrepancies between *congruence* and *habitability* (Gifford, 2002) in residential buildings, and it will be useful in environmental psychology research and in participatory design processes for improving housing conditions and subsequently promoting well-being at both the individual and community levels (Zimring & Reizenstein, 1980).

REFERENCES

Adriaanse, C. C. M. (2007). Measuring residential satisfaction: A residential environmental satisfaction scale (RESS). *Journal of Housing and the Built Environment*, *22*, 287-304. doi:10.1007/s10901-007-9082-9

Alreck, P. L., & Settle, R. B. (1995). *The survey research handbook: Guidelines and strategies for conducting a survey*. Burr Ridge, Il: Irwin.

Amérigo, M. (2002). A psychological approach to the study of residential satisfaction. In J. I. Aragones, G. Francescato, & T. Gärling (Eds.), *Residential environments: Choice satisfaction and behavior* (pp. 81-100). Westport, CT: Bergin & Garvey.

Amérigo, M., & Aragones, J. I. (1990). Residential satisfaction in council housing. *Journal of Environmental Psychology*, *10*, 313-325. doi:10.1016/S0272-4944(05)80031-3

Amérigo, M., & Aragones, J. I. (1997). A theoretical and methodological approach to the study of residential satisfaction. *Journal of Environmental Psychology*, *17*, 47-57. doi:10.1006/jevp.1996.0038

Aragones, J. I., & Corraliza, J. A. (1992). Satisfaccion residencial en ambitos de infravivienda [Residential satisfaction in sub-standard housing]. *Psicothema*, *4*, 329-341.

Arbuckle, J. L. (2007). *Amos 16.0 user's guide*. Chicago, IL: SmallWaters Corporation.

Ariffin, R. N. R., Zahari, N. K., & Nadarajah, S. (2010, July). *Residential satisfaction in private low-cost housing in the urban area: A case study of the Klang Valley, Malaysia*. Paper presented at the 22nd International Housing Research Conference, Istanbul, Turkey.

Baroni, M. R., & Berto, R. (2013). *Stress ambientale: Cause e strategie di intervento* [Environmental stress: Causes and intervention strategies]. Roma, Italy: Carocci.

Bechtel, R., & Churchman, A. (Eds.). (2002). *Handbook of environmental psychology*. New York, NY: Wiley.

Bellini, D., Fornara, F., & Bonaiuto, M. (2015). El entorno positivo en el ámbito laboral: El papel mediador del compromiso laboral entre la restauración y la satisfacción laboral [Positive environment in the workplace: The case of the mediating role of work engagement between restorativeness and job satisfaction]. *Psyecology: Revista Bilingüe de Psicología Ambiental/Bilingual Journal of Environmental Psychology*, *6*, 252-286. doi:10.1080/21711976.2015.1026078

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, *107*, 238-246.

Bonaiuto, M., Aiello, A., Perugini, M., Bonnes, M., & Ercolani, A. P. (1999). Multidimensional perception of residential environment quality and neighbourhood attachment in the urban environment. *Journal of Environmental Psychology*, *19*, 331-352. doi:10.1006/jevp.1999.0138

Bonaiuto, M., & Bonnes, M. (1996). Multiplace analysis of the urban environment: A comparison between a large and a small Italian city. *Environment and Behavior*, *28*, 699-747. doi:10.1177/00139165962800601

Bonaiuto, M., Fornara, F., Ariccio, S., Cancellieri, U. G., & Rahimi, L. (2015). Perceived residential environment quality indicators (PREQIs) relevance for UN-HABITAT City Prosperity Index (CPI). *Habitat International*, *45*, 53-63. doi:10.1016/j.habitatint.2014.06.015

Bonaiuto, M., Fornara, F., & Bonnes, M. (2003). Indexes of perceived residential environment quality and neighbourhood attachment in urban environments: A confirmation study on the city of Rome. *Landscape and Urban Planning*, *65*, 41-52. doi:10.1016/S0169-2046(02)00236-0

Bonnefoy, X. R., Braubach, M., Moissonnier, B., Monolbaev, K., & Röbbel, N. (2003). Housing and health in Europe: Preliminary results of a pan-European study. *American Journal of Public Health*, *93*, 1559-1563.

Bonnes, M., Bonaiuto, M., Aiello, A., Perugini, M., & Ercolani, A. P. (1997). A transactional perspective on residential satisfaction. In C. Despres & C. D. Piché (Eds.), *Housing surveys: Advances in theory and methods* (pp. 99-135). Quebec, Canada: Crad Université Laval.

Bonnes, M., Lee, T., & Bonaiuto, M. (Eds.). (2003). *Psychological theories for environmental issues*. Aldershot, UK: Ashgate.

Bonnes, M., & Secchiaroli, G. (1995). *Environmental psychology: A psycho-social introduction*. London, UK: Sage.

Browne, M. W. (1990). *Mutmum Pc: User's guide.* Columbus, OH: Ohio State University.

Canter, D. (1983). The purposive evaluation of places: A facet approach. *Environment and Behavior*, *15*, 659-698. doi:10.1177/0013916583156001

Canter, D., & Rees, K. (1982). A multivariate model of housing satisfaction. *International Review of Applied Psychology*, *31*, 185-207. doi:10.1111/j.1464-0597.1982.tb00087.x

Carp, F. M., & Carp, A. (1982). Perceived environmental quality of neighborhoods: Development of assessment scales and their relation to age and gender. *Journal of Environmental Psychology*, *2*, 245-312. doi:10.1016/S0272-4944(82)80029-7

Christakopoulou, S., Dawson, J., & Gari, A. (2001). The community well-being questionnaire: Theoretical context and initial assessment of its reliability and validity. *Social Indicators Research*, *56*, 319-349.

Christensen, D. L., & Carp, F. M. (1987). PEQI-based environmental predictors of the residential satisfaction of older women. *Journal of Environmental Psychology*, *7*, 45-64.

Craik, K. H., & Zube, F. (Eds.). (1976). *Perceiving environmental quality: Research and application*. New York, NY: Plenum Press.

de Carvalho, F. A., & Leite, V. F. (1999). Attribute importance in service quality: An empirical test of the PBZ conjecture in Brazil. *International Journal of Service Industry Management*, *10*, 487-504.

Elsinga, M., & Hoekstra, J. (2005). Homeownership and housing satisfaction. *Journal of Housing and the Built Environment*, *20*, 401-424. doi:10.1007/s10901-005-9023-4

European Commission (2004). *How Europeans spend their time: Everyday life of women and men*. Luxembourg: Office for official publications of European communities.

Evans, G. W. (2003). The built environment and mental health. *Journal of Urban Health*, *80*, 536-555.

Evans, G. W., & Cohen, S. (2004). Environmental stress. In C. Spielberger (Ed.), *Encyclopedia of applied psychology* (Vol. 1., pp. 815-824). New York, NY: Elsevier.

Evans, G. W., & McCoy, M. J. (1998). When buildings don't work: The role of architecture in human health. *Journal of Environmental Psychology*, *18*, 85-94. doi:10.1006/jevp.1998.0089

Felce, D. (1997). Defining and applying the concept of quality of life. *Journal of Intellectual Disability Research*, *41*, 126-135. doi:10.1111/j.1365-2788.1997.tb00689.x

Fornara, F., Bonaiuto, M., & Bonnes, M. (2006). Perceived hospital environment quality indicators: A study of orthopedic units. *Journal of Environmental Psychology*, *26*, 321-334. doi:10.1016/j.jenvp.2006.07.003

Fornara, F., Bonaiuto, M., & Bonnes, M. (2010). Cross-validation of abbreviated perceived residential environment quality (PREQ) and neighborhood attachment (NA) indicators. *Environment and Behavior*, *42*, 171-196. doi:10.1177/0013916508330998

Galati, D., Manzano, M., & Sotgiu, I. (2006). The subjective components of happiness and their attainment: A cross-cultural comparison between Italy and Cuba. *Social Science Information*, *45*, 601-630. doi:10.1177/0539018406069594

Galati, D., Sotgiu, I., & Iovino, V. (2006). What makes us happy? A study on the subjective representation of happiness components. In A. Delle Fave (Ed.), *Dimensions of well-being. Research and intervention* (pp. 60-74). Milano, Italy: FrancoAngeli.

Galster, G. (1987). Identifying the correlates of dwelling satisfaction: An empirical critique. *Environment and Behavior*, *19*, 539-568. doi:10.1177/0013916587195001

Galster, G. C., & Hesser, G. W. (1981). Residential satisfaction compositional and contextual correlates. *Environment and Behavior*, *13*, 735-758. doi:10.1177/0013916581136006

Gifford, R. (2002). *Environmental psychology: Principles and practice*. Boston, MA: Allyn and Bacon.

Grzeskowiak, S., Sirgy, M. J., Lee, D. J., & Claiborne, C. B. (2006). Housing well-being: Developing and validating a measure. *Social Indicators Research*, *79*, 503-541. doi:10.1007/s11205-005-5667-4

Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparametrized model misspecification. *Psychological Methods*, *3*, 424-453.

Hwang, T., & Kim, J. T. (2011). Effects of indoor lighting on occupants' visual comfort and eye health in a green building. *Indoor and Built Environment*, *20*, 75-90. doi:10.1177/1420326X10392017

Istat (2011). *La popolazione legale del 15° Censimento della popolazione* [15th Population and housing census 2011]. Retrieved September 23, 2014, from http://www.istat.it/it/archivio/77877

Joe, V. C., Jones, R. N., & Ryder, S. (1977). Conservatism, openness to experience and sample bias. *Journal of Personality Assessment*, *41*, 527-531.

Jöreskog, K. G., & Sorbom, D. (1996). *LISREL 8: User's reference guide*. Chicago, IL: Scientific Software International.

Larson, R. (1978). Thirty years of research on the subjective well-being of older Americans. *Journal of Gerontology*, *33*, 109-125.

Leather, P., Beale, D., & Sullivan, L. (2003). Noise, psychosocial stress and their interaction in the workplace. *Journal of Environmental Psychology*, *23*, 213-222. doi:10.1016/S0272-4944(02)00082-8

Lu, M. (1999). Determinants of residential satisfaction: Ordered logit vs. regression models. *Growth and Change*, *30*, 264-287. doi:10.1111/0017-4815.00113

Mao, Y., Fornara, F., Manca, S., Bonnes, M., & Bonaiuto, M. (2015). Perceived residential environment quality indicators and neighborhood attachment: A confirmation study on a Chinese sample in Chongqing. *PsyCh Journal*, *4*, 123-137. doi:10.1002/pchj.90

Marans, R. W. (2003). Understanding environmental quality through quality of life studies: The 2001 DAS and its use of subjective and objective indicators. *Landscape and Urban Planning*, *65*, 73-83. doi:10.1016/S0169-2046(02)00239-6

Meloen, J. (1993). The F Scale as a predictor of fascism: An overview of 40 years of authoritarianism research. In W. F. Stone, G. Lederer, & R. Christie (Eds.), *Strength and weakness: The authoritarian personality today* (pp. 47-69). New York, NY: Springer.

Michalos, A. C. (1980). Satisfaction and happiness. *Social Indicators Research*, *8*, 385-422.

Michalos, A. C. (1982). The satisfaction and happiness of some senior citizens in rural Ontario. *Social Indicators Research*, *11*, 1-30.

Michalos, A. C. (1983). Satisfaction and happiness in a rural northern resource community. *Social Indicators Research*, *13*, 225-252.

Michalos, A. C. (1985). Multiple discrepancies theory (MDT). *Social Indicators Research*, *16*, 347-413.

Mohit, M. A., Ibrahim, M., & Rashid, Y. R. (2010). Assessment of residential satisfaction in newly designed public low-cost housing in Kuala Lumpur, Malaysia. *Habitat International*, *34*, 18-27. doi: 10.1016/j.habitatint.2009.04.002

Muthén, L. K., & Muthén, B. O. (1998). *Mplus user's guide*. Los Angeles, CA: Author.

Oswald, F., Schilling, O., Wahl, H. W., Fänge, A., Sixsmith, J., & Iwarsson, S. (2006). Homeward bound: Introducing a four-domain model of perceived housing in very old age. *Journal of Environmental Psychology*, *26*, 187-201. doi:10.1016/j.jenvp.2006.07.002

Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1994). Alternative scales for measuring service quality: A comparative assessment based on psychometric and diagnostic criteria. *Journal of Retailing*, *70*, 201-230. doi:10.1016/0022-4359(94)90033-7

Power, M., Harper, A., & Bullinger, M. (1999). The World Health Organization WHOQOL-100: Tests of the universality of quality of life in 15 different cultural groups worldwide. *Health Psychology*, *18*, 495-505. doi:10.1037//0278-6133.18.5.495

Primi, C. (2002). *Indici di bontà di adattamento nei modelli di equazioni strutturali* [Fit indexes in structural equations modelling]. Firenze, Italy: Loggia de' Lanzi.

Race, G. L. (2006). *Comfort: CIBSE Knowledge Series KS6*. London, UK: CIBSE.

Rasch, G. (1960). *Probabilistic models for some intelligence and attainment tests*. Copenhagen, Denmark: The Danish Institute of Educational Research.

Rashid, M., & Zimring, C. (2008). A review of the empirical literature on the relationships between indoor environment and stress in health care and office settings: Problems and prospects of sharing evidence. *Environment and Behavior*, *40*, 151-190. doi:10.1177/0013916507311550

Roccato, M., Rosato, R., Mosso, C. O., & Russo, S. (2014). Measurement properties of the System Justification Scale: A Rasch analysis. *TPM – Testing, Psychometrics, Methodology in Applied Psychology*, *21*, 467-478. doi:10.4473/TPM21.4.7

Schuman, H., & Presser, S. (1981). *Questions and answers: Experiments on question form, wording, and context in attitude surveys*. New York, NY: Academic Press.

Sears, D. O. (1986). College sophomores in the laboratory: Influences of a narrow data base on social psychology's view of human nature. *Journal of Personality and Social Psychology*, *51*, 515-530.

Shin, D. C., & Johnson, D. M. (1978). Avowed happiness as an overall assessment of the quality of life. *Social Indicators Research*, *5*, 475-492.

Stokols, D., Altman, I. (Eds.). (1987). *Handbook of environmental psychology*. New York, NY: Wiley.

Ulrich, R. S., Zimring, C., Joseph, A., Quan, X., & Choudhary, R. (2004). *The role of the physical environment in the hospital of the 21st century: A once-in-a-lifetime opportunity*. Princeton, NJ: Robert Wood Johnson Foundation.

United Nations Human Settlements Programme (1996, April). *The habitat agenda: Goals and principles, commitments and the global plan of action*. Paper presented at the 2nd Habitat Conference, Istanbul, Turkey. Retrieved April 15, 2014 from http://ww2.unhabitat.org/declarations/habitat_agenda.asp

United Nations Human Settlements Programme (2010). *A practical guide for conducting: Housing profiles*. Retrieved September 29, 2014, from http://unhabitat.org/books/a-practical-guide-for-conducting-housing-profiles-revised-version/

van Praag, B. M. S., Frijters, P., & Ferrer-i-Carbonell, A. (2003). The anatomy of subjective well-being. *Journal of Economic Behavior and Organization*, *51*, 29-49.

Vischer, J. C. (2007). The effects of the physical environment on job performance: Towards a theoretical model of workspace stress. *Stress and Health*, *23*, 175-184. doi:10.1002/smi.1134

Winston, N., & Eastaway, M. P. (2008). Sustainable housing in the urban context: International sustainable development indicator sets and housing. *Social Indicators Research*, *87*, 211-221. doi:10.1007/s11205-007-9165-8

World Health Organization Group (1994). Development of the WHOQOL: Rationale and current status. *International Journal of Mental Health*, *23*, 24-56.

World Health Organization Group (1998). The World Health Organization quality of life assessment (WHOQOL): Development and general psychometric properties. *Social Science & Medicine*, *46*, 1569-1585.

World Health Organization Regional Office for Europe (2007). *Large analysis and review of European housing and health status (LARES): Preliminary overview*. Copenhagen, Denmark: WHO Regional Office for Europe.

Zimring, C. M., & Reizenstein, J. E. (1980). Post-occupancy evaluation: An overview. *Environment and Behavior*, *12*, 429-450. doi:10.1177/0013916580124002