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Psychological restoration and urban nature: some mental health implications

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Original article

SUMMARY

Topics relating to mental health promotion systematically lack research that documents the importance of qualities in the physical environment in the development of public health policies. At the present time, several emerging lines of research regarding restorative environments (RE) and psychological restoration (PR) may contribute to the conceptual and operational definition of relevant environmental qualities promoting mental health. PR relates to the recovery of people´s cognitive resources and psychophysiological responses when exposed to environments with restorative qualities. The present study documents the application of an ecological social model regarding the impact of urban nature on PR in a housing context. We posed the objective to document the possible restorative effects of variables related to Urban Nature-UN (for example, views of nature from housing windows, indoor plants and gardens, proximity to outdoor green areas) and Psychological Transaction Processes with the Environment - PTRAPE (activities in nature and perception of the environmental restoration of housing) on emotional and cognitive indicators of PR. To achieve this goal, we carried out a study with 120 individual home interviews (mean age of 45.73 years, 63 men and 57 women) in the metropolitan area of Mexico City. The structural equations model showed that UN has both direct and indirect effects on emotional and cognitive dimensions of PR. This theoretical, conceptual, and methodological approach provides a conceptual platform to carry out innovative research with relevant empirical implications for promoting mental health.

Key words: Restorative environments, public health, stress, environmental perception.

RESUMEN

En las temáticas de promoción de salud mental existe una carencia sistemática de investigaciones que documenten la importancia de las cualidades del ambiente físico en el desarrollo de políticas públicas de salud. Actualmente existen varias líneas emergentes de investigación sobre ambientes restauradores (AR) y restauración psicológica (RP) que pueden contribuir a la definición conceptual y operativa de las cualidades del ambiente que pueden ser relevantes para promover la salud mental. La RP se relaciona con la recuperación de los recursos cognitivos y de la capacidad de respuesta psicofisiológica que experimentan las personas ante la exposición a ambientes con cualidades restauradoras. En el presente estudio se documenta la aplicación de un modelo ecológico social del impacto de la naturaleza urbana en la RP considerando un contexto de vivienda. Se planteó como objetivo documentar los posibles efectos restauradores de variables relacionadas con la presencia de Naturaleza Urbana-NU (e.g. vistas de naturaleza en las ventanas de las viviendas, plantas y jardines interiores, proximidad de áreas verdes exteriores), Procesos Psicológicos de Transacción con el Medio Ambiente - PPTRAMA (actividades con la naturaleza y percepción de restauración ambiental de la vivienda) sobre indicadores emotivos y cognitivos de la RP. Para conseguir tal objetivo se ha llevado a cabo un estudio en el que se entrevistaron en sus domicilios a 120 personas (edad media 45.73 años, 63 hombres y 57 mujeres) de la Zona Metropolitana de la Ciudad de México. Por medio de un modelo de ecuaciones estructurales se comprobó que la NU tiene efectos directos e indirectos en la dimensión emotiva y cognitiva de la RP. Del abordaje teórico, conceptual y metodológico se desprende una plataforma conceptual a partir de la cual es posible desarrollar investigación innovadora con implicaciones empíricas relevantes para la promoción de la salud mental.

Palabras clave: Ambientes restaurativos, salud pública, estrés, percepción ambiental.

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INTRODUCTION

Social problems and environmental stressors are frequently involved in highly urbanized[1] scenarios and also influence psychiatric disorders such as schizophrenia and depression.[2] It is estimated that one in every four people will suffer a mental or neurological disorder at some time in their lives, and some 450 million people currently suffer from these

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disorders.[3] In Mexico, the National Survey on Psychiatric Epidemiology[4] reports that 9.2% of the population has had a depressive disorder in their lifetime. Negative emotional states linked with stress (eg. anxiety and hostility) have been consistently related with heart diseases.[5] Furthermore, various chronic illnesses such as cancer, high blood pressure, and type II diabetes are also connected with stress.[6] Stress, a syndrome of modern urbanization, causes at least $100 billion US dollars to be spent annually around the world on medical consultations and treatments.*[,7] This implies an investment into public health that is potentially threatening for the economy of communities.[8,9]

The World Health Organization (WHO) usually defines health as a state of complete physical, mental, and social wellbeing, and not just the absence of conditions or illnesses.** Mental health is a multidimensional concept that involves an internal emotional and mental balance, subjective wellbeing, the perception of one's own efficacy or functioning, the capacity to adequately manage stress, autonomy, self-realization of intellectual capacity, and the ability to live harmoniously with others.[10] Nowadays it seems paradoxical that this perspective of positive mental health has a lower resonance in mental health models; models of illness being particularly notable among these.[11,12] The foundations of mental health are related to the promotion of wellbeing, the prevention of mental disorders, and the treatment and rehabilitation of people affected by these disorders.[13] These bases are usually oriented towards the health care behaviors of individuals (eg., individual health habits and lifestyles);[14] they consider mental health the result of a balance between the biological and social aspects of the individual[15] and they tend to focus less on the physical environment as a source that can promote health.[16] Public health policies recognize the role of the combined action of numerous biological, psychological, social, and environmental factors in determining an individual's state of psychic health or whether they will suffer from mental and behavioral disorders.[15] Even if such policies make clear the biological, psychological, and social mechanisms at work to promote health,[17] there have been few records of factors around the physical[18] (not social) environment having positive (not just negative) effects on mental health. In this sense, there are various emerging lines of research that can significantly contribute to the conceptual and operational definition of the physical qualities of the environment which are relevant to promoting mental health from psychology and other related disciplines.[19]

Nowadays there is sufficient scientific evidence to promote the existence of environments whose qualities can be catalysts for psychological processes linked with mental health. Various studies have demonstrated that contact with nature can contribute to reducing stress and promoting positive states of mood and adequate cognitive function (attention).[20-23] These effects, known as restorative effects, have been widely documented in literature on perception of environmental restoration[24,25] and PR.[26,27] Psychological restoration (hereafter known as PR) is related with the recovery of cognitive resources and the capacity for psychophysiological response experienced by people exposed to environments with restorative qualities.[28] The context where this recovery occurs is known as a restorative environment, and the physical and psychological dimensions that contribute to an environment being perceived as restorative are known as restorative qualities.[24] These qualities can vary in terms of the environment assessed. People tend to attribute more restorative qualities to natural environments than to urban ones without any nature. Between urban settings, those with the presence of urban nature (green spaces, gardens, parks, window views with plants, etc.) promote a greater restorative potential than those without.[29] The bibliography on the restorative effects of urban nature identifies four environmental variables that are critical in promoting a process of PR: a) visibility of appreciable greenery through the windows;[30] b) gardens and potted plants;[31] c) images of nature;[32] and d) the proximity of outdoor green areas.[21] Furthermore, other variables have been correlated, such as e) the perception of environmental restoration and f) activities with nature,[33] in conjunction with the aforementioned environmental variables, considering physiological,[34] emotional,[35] and attentional[36] indicators. Despite there already being evidence for the role of these variables in the promotion of PR, little is known of the assessment of said variables in terms of their possible restorative influence in a context of urban housing. As such, the objective of the present work is to document the possible restorative effect of residential urban nature,[37] considering an ecological social model of the impact of urban nature on psychological restoration.

Fundamentally, said model will consider: a) a contextual and salutogenic orientation related to the psychological and behavioral processes which favor physical and emotional wellbeing, b) emphasis on the transactions that occur between the individual and the physical and social surroundings over time, c) the multifaceted nature of environmental conditions on people's health and wellbeing, and d) identification of key environmental resources that probably influence personal and collective wellbeing among members of a scenario (exposure to restorative environments–RE and its effect on dimensions of PR).[38] Figure 1 shows that the variable of UN includes the dimension of *nature at home*, which alludes to the visibility of greenery from the windows of a home, gardens and pot plants, images of nature within the home, and the *proximity of outdoor green areas*, which refers to how far away the green area is from the home in both time and distance. The Psychological Transaction Processes with

* One billion in US dollars is equivalent to a thousand million.

** Preamble of the World Health Organization Constitution adopted by the International Sanitary Conference signed in New York on July 22 1946 by representatives of 61 States.

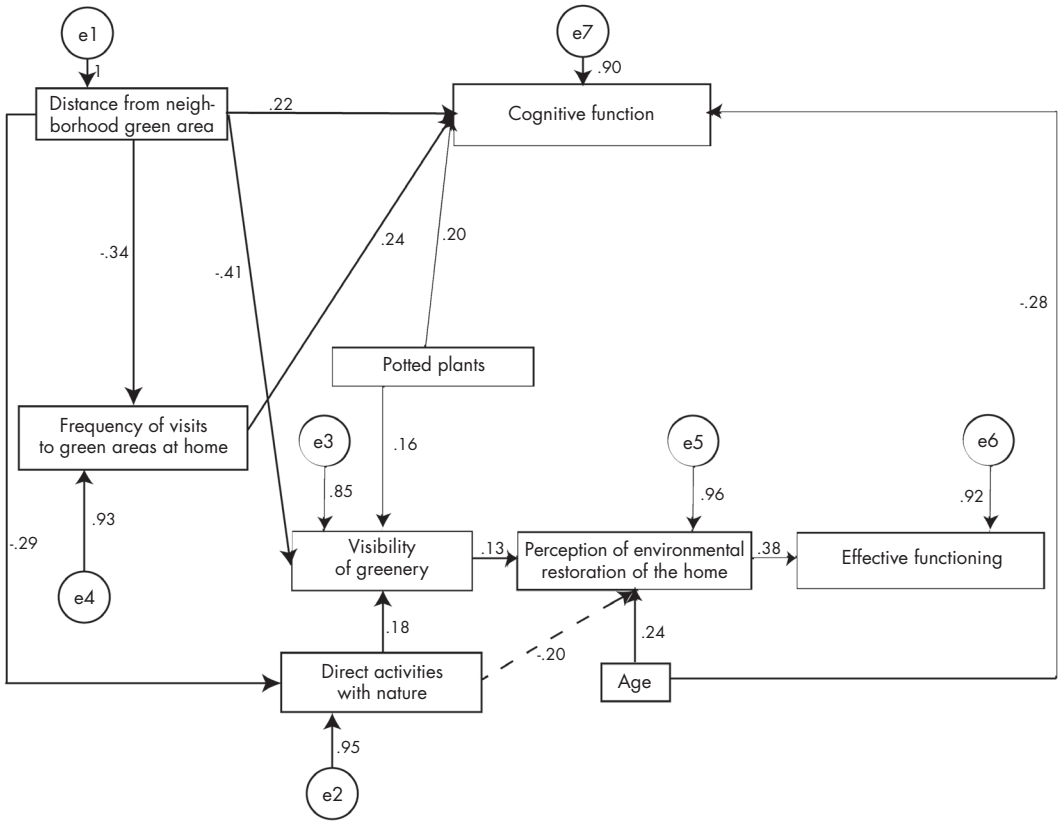

Figure 1. Ecological Social Model of the impact of Urban Nature on psychological restoration.

the Environment (PTRAPE) refers to variables of *perception of environmental restoration in the home*, which is about the perception of the home's restorative qualities, and *activities with nature* which covers intentional behavior and circumstance, whether active or passive, periodic or sporadic,[24] with nature. PR represents two dimensions: *cognitive function*, related with the capacity for concentration and directed attention, and the *emotional dimension*, measured as an increase in positive emotions and a sensation of effective functioning.[39] From the model cited, hereafter referred to as the Ecological and Social Model of the Impact of Urban Nature in PR (EcSocNU for its acronym in Spanish), the following research question was derived: What is the magnitude and the direction of existing relationships between UN variables (nature in the home and proximity of outdoor green spaces) and PTRAPE (perception of environmental restoration in the home and activities with nature), considering that of PR dimensions (cognitive and emotional)?

Three hypotheses were derived from the investigation described: a) UN variables will have a positive and significant impact on the cognitive and emotional dimensions of PR; b) there will be positive and significant relationships between UN and PTRAPE; c) UN variables will tend to have a positive and significant impact on the cognitive and emotional dimensions of PR through PTRAPE.

METHOD

Participants

By means of an intentional sample, 120 at-home interviews were conducted with residents of a neighborhood in the eastern part of the Metropolitan Zone of Valle de Mexico. The age of the participants ranged between 17 and 79 years, with an average age of 45.73 years (*SD*=14.23). Of the total sample, 63 participants (52.5%) were males, and 57 (47.5%) were females.

Setting of the study

The neighborhood where the questionnaires were carried out is located to the east of Mexico City, zip code 57179. It was chosen due to presenting certain physical and social conditions with homogenous characteristics which allowed possible outside sources of variability related to differences with the physical and social environment to be controlled.[40] Among the physical aspects were qualities of the housing: size of the property, the type of home, and the housing density. In terms of property size, 15.5% of the houses had more than 80m^2 of land, while the remaining 84.5% had a range between 60 and 80m^2 (trend=75m^2). In terms of type

of home, 97.4% corresponded to the "duplex" type of architectural design. Regarding the social aspects, the socioeconomic level of the zone was balanced, and considered a level of middle class.*

Instruments and measurements

Nature in the Home Scale [ENC for its acronym in Spanish]. The ENC[41] quantifies the visibility of greenery visible through the windows of the home and visibility from the street in terms of percentages (*none*: 0 to 3% through to *almost all*: 97 to 100%). A checklist was used to assess the presence of potted plants, gardens, and images of nature (eg. posters) within the home. Content validity was obtained in a previous study by consulting three experts in environmental psychology and one in ecology. This same study assessed the inter-judgment reliability, with the participation of three experts in environmental psychology who assessed dozens of photographs of windows with nature and carried out eight extensive evaluation sessions with the checklist in different housing situations. In these sessions, 94% agreement was obtained in terms of the qualities to be measured. This criteria meets the expectations for reliability between judges that allows this instrument to be used in the field.[42] *Proximity of outdoor green spaces*. A digital pedometer was used which recorded the distance in time and meters from the closest green common area to the participants. For analysis purposes, this will hereafter be described as 'distance from the neighborhood green area'. *Transactions with Nature Scale* (ETRAN for its acronym in Spanish).[41] This was used to assess activities with nature. It is a uni-dimensional scale (α total=0.61) with 11 items and an answer format of five options that range from *(0) never* to *(5) every day*. The instrument includes direct ("gardening") and indirect ("listening to CDs of nature sounds") activities with nature. *Revised Scale of Perception of Restorative Environments* (EPRA-R[43] for its acronym in Spanish). This was used to measure the perception of the environmental restoration of the housing. It has 26 scaled items with response options from *0=nothing* through *10=completely* and five factors: Fascination (α=.81), Stay Away (α=.76), Compatibility (α=.75), Coherence (α=.70), and Reach (α=.81), as well as two items that indicate environmental preference. In terms of the validity of the EPRA-R, in a previous study, Martínez-Soto and Montero[43] documented evidence of discriminant[44] and concurrent validity (via the use of a stress and activation scale).[45] *Reverse Order Digit Span Subtest*.[46] This was used to assess the cognitive dimension of PR in terms of changes in directed attention.[47] This test depends on the attention directed due to the participants having to move in and out of their attentional focus[48] which is a major component of short-term memory.[49] The test consists of a series of seven pairs of random numbers in ascending order being read to the participant, who then has to repeat them. In assessing the crude scores, the examiner must give a range of points; 4 or 5 within the normal limits, 3 as limited or defective, depending on the participant's education, and 2 as defective.[50] *Wellbeing Scale* (EB for its acronym in Spanish) adapted from Kaplan[23] by Martínez-Soto[41] for a Mexican population). This was used to provide evidence of the emotional dimension of PR. It has three factors: Effective Functioning (α=.84), Calmness (α=.80), and Distraction (α=.72), with 26 items and five optional responses from (0) for never to (4) to very frequently.

* SIGMA DOS MEXICO. Market studies.

Procedure

The data was collected by three surveyors (postgraduate students in environmental psychology) who were exhaustively trained (three hours of general training in data collection techniques, eight hours on collecting direct records, and 20 supervised hours in the field applying the suite of instruments). When the instruments were administered, an interviewer carried out the indirect records (psychological variables), while a second surveyor or co-observer conducted a detailed list of observations corresponding to the indirect records and to the ENC and proximity to outdoor green areas. The average time to create the records was 45 minutes per home.

Data analysis

Descriptive statistics were obtained to see to what extent the data was grouped around a central value. With the aim of knowing the direct and indirect relationships proposed in the EcSocNU model, Structural Equation Modeling (SEM) was carried out.[51] To assess the goodness of fit, the RMSEA[52] index of absolute fit was applied, which requires that the error does not exceed .05. Three increase or adjustment level indexes were used: a) Comparative Fit Index, b) the Tucker-Lewis Index, and c) the Normed Fit Index. The acceptance criteria for these indexes was between .90 and 1.00.[53]

RESULTS

Table 1 shows the descriptive statistics of the variables.

Of the 120 homes assessed with the ENC, it was found that a little under half (42.9%) had some sort of garden. Furthermore, the visibility of nature from the street was one of the perspectives in which the majority could see nature, followed by views from the living room and the bedroom. Low average scales were found (scale of 0 to 2) both for images of nature (*M*=.45; *SD*=.37) as well as for potted plants (*M*=1.32; *SD*=.65). In terms of distance from the neighborhood green area or other green area, it was found that on average, these areas are within three minutes of the homes

Table 1. Descriptive statistics for variables of PTRAPE and PR

Variable	Dimension	n	Median	SD	Response range
Activities with nature	DAN	119	1.51	0.65	0 - 5
	IAN		1.61	0.85	0 - 5
Perception of environmental restoration of the home	FA	119	7.32	1.74	0 - 10
	SA		6.76	2.20	0 - 10
	COM		8.47	1.57	0 - 10
	COH		7.84	1.82	0 - 10
	R		6.74	2.05	0 - 10
Psychological restoration emotional indicators	EF	119	3.17	0.61	0 - 4
	C		2.53	0.79	0 - 4
	D		1.53	0.75	0 - 4
Psychological restoration cognitive indicator	RDOS	119	4.22	1.27	——

Note: DAN=Direct Activities with Nature; IAN=Indirect Activities with Nature; FA=Fascination; SA=Stay away; COM=Compatibility; COH=Coherence; R=Reach; EF=Effective functioning; C=Calmness; D=Distraction; RODS=Reverse Order Digit Span.

surveyed. On the other hand, the majority of respondents reported visiting the nearby green areas relatively frequently (42.5%) while 14.5% said they never visited. In terms of activities with nature, scores below the scale average were found (scale from 0 to 5, *M*=1.56, *SD*=.75; Table 1). The median scales for the restorative qualities of the home in general were above average (*M*=7.42, *SD*=.73) scale from 0 to 10. In terms of the emotional dimensions of PR, the Emotional Functioning factor of the EB obtained the highest scale average, followed by Calmness, and finally, Distraction. On the other hand, in terms of cognitive functioning represented by the Reverse Order Digit Span Subtest, a median of 4.22 was obtained, a score which approaches normal averages for an adult population.[50]

Trajectory analysis

Variables from at least one of each general category of the EcSocNU theoretical model were included in the empirical model (Figure 1), which made it possible to show a theoretical and empirical fit of the data. The model was made up of nine out of 16 variables observed (Figure 2) covering a sample of 113 cases that met the criterion of not having any value lost. This sample size meets the minimum criteria for parameters and cases to consider in a structural model.[54]

The indexes obtained for the EcSocNU model were X^2=29.56, *gl*=23, *avg*=.16, from which it was gleaned that the model was well adjusted to the data, given that in this case, the value of X^2 is small and the associated probability is not significant.[55] The RMSEA index of absolute fit was .05, the same as was found within the limits that correspond to a good fit.[56] In terms of the incremental fit indices, values of CFI=.93, TLI=.90, and NFI=.78 were reported. This last

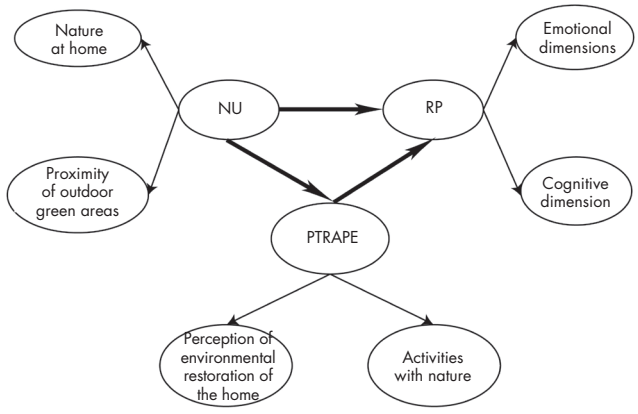

Figure 2. Model of restorative influence of urban nature. Indications of goodness of fit X^2=29.56, gl=23, p=.26, NFI=.78 y RMSEA=.05.

value, unlike the other more stable indicators, did not obtain the desired value (>.90); however, considering it as an indicator which is sensitive to the sample size allows for the cautious assumption that the model is well adjusted.[51] On the other hand, the value of R^2 obtained was .15 for effective functioning and .19 for cognitive functioning. The values corresponding to standardized errors showed values from 1 to a value of .85. These results indicate the importance of the findings in relationships of the variables studied with the precautions of interpretation imposed by the values of error in measurement.[52]

The variables observed that predicted cognitive function positively and significantly were: potted plants (.20) and frequency of visiting green areas outside the home (.24). On the other hand, it was unexpectedly found that there was better cognitive function at a greater distance from the common neighborhood green area (.22).

As seen in Figure 2, various points begin with the distance of the common green area. This variable also had an indirect impact on cognitive function through the frequency of visits to green areas outside the home (-.34). The variable 'perception of environmental restoration of the home' (considered the overall average score of five EPRA-R factors) served as a mediating variable in the UN relationship and for emotional restorative effect. The visibility of greenery presented an inverse correlation with the distance from the neighborhood green area (-.41), and a direct correlation with the presence of potted plants (.16) to later affect the perception of environmental restoration of the housing (.13) and finally emotional function (.38).

Another of the points found corresponded to the inverse correlation of the distance from the neighborhood green area with direct activities with nature (-.29); however, this did not have an effect on the perception of the environmental restoration of the home. Finally, it is worth pointing out the positive influence that age had on the perception of environmental restoration of the home (.24) and the negative

relation it has on cognitive function (-.28), which suggests that the older the age, the worse the cognitive function.[57]

DISCUSSION

The present study stemmed from the need to show that there were factors in the physical environment that can have positive repercussions on mental health. Starting from an ecological social approach,[38] and deriving from the study of RE and PR,[24,28] an Ecological Social model was proposed for the impact of Urban Nature on PR (EcSocNU). By means of that model, the relationships between UN variables and PTRAPE were documented, considering their impact on two dimensions of PR. The first hypothesis proposed that the UN variables would have a positive and significant impact on the PR dimensions. In this respect, it was demonstrated that positive and significant effects existed with the variable of potted plants on the cognitive dimension of PR, which also coincides with previous research.[23,58] Furthermore, it was confirmed that the frequency of visits to green areas outside of the home had a positive impact on cognitive function (.24). Unexpectedly, a better cognitive function was found at a greater distance from the home. This negative relationship reminds us of some of the relevant principles to consider in the study of RE[41] which are to do with temporality in exposure to RE. The same type of environment may not be restorative for all people, and not all the time; moreover, exposure time in an isolated manner does not guarantee psychological restoration,[59] and in terms of a positive impact of the distance from green areas and cognitive function, it is worth considering the influence of other psychological variables, for example, the need for individual restoration[60] and attitudes towards green urban areas.[61] In certain cases, neighborhood green areas could be perceived as a threat by certain residents, as they hide dangerous animals or are perceived as the setting for crimes or areas contaminated by waste. Furthermore, independently of direct physical contact with nature, evidence from the field of neuroscience suggests that in shaping restorative experiences, episodic memory and visual imagery can play as active a role as visual perception in PR.* A second hypothesis proposed the existence of positive and significant relationships between the UN and PTRAPE variables. In this sense, the visibility of greenery was documented as a critical variable for promoting the perception of environmental restoration of the home, which is in line with previous research.[26,29] A third hypothesis proposed that the UN variables would have a positive and significant impact on the dimensions of PR, through PTRAPE variables. The perception of the home's environmental restoration was documented as an aspect that measures the relationship between UN (eg. distance from the neighborhood green area, visibility, and potted plants) and PR in terms of the emotional indicator of effective functioning. Theories about environmental psychological restoration[62,63] are not usually very clear in terms of the role that certain socio-demographic variables can play (eg. age and gender) in the perception of restorative qualities of the environment. Within the empirical EcSocNU model, the relationship between age and perception of the environmental restoration of the home can be noted. Some studies suggest that changes in people's life cycle can impact the perception they have of restorative components.[64] This research found that at older ages, there is a greater perception of the home's environmental restoration, from which it can be gleaned that restorative components are valued more greatly by adults compared to young people.[43] Like the majority of studies within this little-explored area of research on PR in urban settings considering the context of the home, the present work has certain limitations that open up new lines of enquiry. The results obtained allude to people's restorative experiences within their own settings and not in laboratory conditions. Even if it is desirable to control variables as a means to increase the certainty of the implications generated, it is not always feasible to reproduce prevalent conditions of a natural setting in a laboratory; such is the case of environmental restoration. The present research did not include physiological measures that gave evidence of PR. Future research might consider this type of record. The value obtained in terms of the percentage of variance explained for the model was 14%. The low predictive power achieved in the model demonstrates the complexity of assessing the restorative influence of urban nature. It is suggested that future studies consider including other variables that could maximize the systematic variance, among them people's need for restoration, attitudes towards green areas, the actual exposure time to nature (dose of nature vs. psychological benefits obtained), and possible factors of habitation to green areas.[41] The high standardized errors within the models –the same that imply other non-specified influences–[65] could be minimized by eliminating sources of fatigue (by using shorter instruments) and incorporating more participants in the sample.[56] Furthermore, this type of variability could be reduced by incorporating another set of variables not initially included in the model.[56]

On the other hand, diverse methodologies were used in concordance with an ecological social approach (eg. direct and indirect records) to assess the settings within and without the home.[66] This constitutes a novel methodological contribution for the study of PR in residential urban settings. The study of RE and PR constitutes relevant lines of research for promoting mental health. Restorative effects allude to a reduction in stress levels, promoting better capacity for concentration and directed attention, positive mood states, and

* Martínez-Soto, J. Gonzáles-Santos, L. & Barrios, F. 2012. Psychological Restoration: an evaluation of some neural correlates. 22 IAPS Conference, Glasgow, Escocia, UK.

a feeling of effective functioning.[20,21] Mental health includes the pleasure of emotional and cognitive balance, subjective wellbeing, a feeling of effective functioning, and a capacity to deal adequately with stress. The restorative influence of urban nature may constitute one of the most accessible psychological benefits for promoting mental health in urban settings. In this sense, future studies could document the relationship between the restorative effects of contact with nature and assessments of mental health.[11] Furthermore, it is important to value the conservation of nature in the public health environment, on central reserves and major roadways, given that according to the findings, these are aspects that promote important psychological benefits. Similarly, the following implications can be derived from the findings obtained: contact with natural elements can promote mental health; developing urban settings should be balanced with access to natural spaces; psychology can work jointly with other disciplines like medicine, ecology, and urban development, among others, in developing instruments that document the impact of the environment's physical qualities (such as urban nature) on individuals' physical and mental health. An ecological-social approach offers a conceptual platform from which innovative research can be developed with relevant empirical implications for the promotion of mental health. From these implications, it can be gleaned that psychology can contribute to developing public health policies that promote optimal function, both of the individual as well as communities.

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