

Olga Flores-Cano\*

## Defining well-being for the inhabitants of Mexico City

### Definiendo el bienestar de los habitantes de la Ciudad de México

**Abstract** | Studied worldwide, well-being is an important principle for the modern societies and needs to reflect the local cultures of the targeted populations. Semantic networks and graph theory address this issue: a definition of well-being comes directly from a sample of the targeted population. The stage one (N = 201, 52% female and 48% male, volunteers—*informed consent provided*—, 20 years and older, mean = 39.97 years, S.D. = 13.56 years) semantic networks defined well-being. In stage two the networks were the foundation to construct two scales which were validated (sample N = 427, 55% female and 45% male, volunteers—*informed consent provided*— 20 years and older, mean = 37.75 years, S.D. = 12.54 years). Analyzed with graph theory, well-being resulted in a social complex system (non-linearity, small world phenomenon, emergency), and showed the main elements to define well-being (affect and cognitive components). Its subgraphs were arranged into three main domains with subdomains: health (physical and psychological), relationships (family, friends, community) and resources (personal, material, time). The scale of satisfaction with well-being ( $\alpha = .912$ ) and the scale of experiences of well-being ( $\alpha = .969$ ) showed a good fit and obtained adequate values. Semantic networks proved to be a good resource to help in the construction of a questionnaire to study well-being with a cultural perspective.

**Keywords** | well-being | Mexico City | networks | graph | definition.

**Resumen** | El bienestar es un principio importante para las sociedades modernas. En su investigación es necesario que se refleje la cultura local de la población estudiada. Las redes semánticas y la teoría de grafos apoyan este fin pues la definición del bienestar se deriva directamente de la muestra de la población de interés. En la etapa uno (N = 201, 52% mujeres y 48% hombres, voluntarias[os] —*con consentimiento informado*—, 20 años y mayores, media = 39.97 años,

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D.E. = 13.56 años) se generaron redes semánticas para definir el concepto de bienestar. En la etapa dos las redes semánticas fueron el fundamento para la construcción de dos escalas que se validaron (N = 427, 55% mujeres y 45% hombres, voluntarias[os] —con consentimiento informado— 20 años y más, media = 37.75 años, D.E. = 12.54 años). Analizado con la teoría de grafos, el bienestar resultó ser un sistema social complejo (no lineal, fenómeno de mundo pequeño, emergencia), y mostró los principales elementos para definir el bienestar (componentes afectivos y cognitivos). De los subgrafos se derivaron los tres principales dominios con sus subdominios: salud (física y psicológica), relaciones significativas (familia, amigas[os], comunidad) y recursos (personales, materiales, de tiempo). La escala de satisfacción con el bienestar y la escala de experiencias de bienestar tuvieron buen ajuste mostrando valores adecuados. Las redes semánticas probaron ser un buen recurso para ayudar en la construcción de un cuestionario para estudiar el bienestar subjetivo con una perspectiva culturalmente relevante.

**Palabras clave** | bienestar | Ciudad de México | redes semánticas | grafos | definición.

## Background

MANY TERMS WERE USED TO ADDRESS WELL-BEING, such as happiness, life satisfaction, quality of life (Veenhoven 2012); also, various fields of study research well-being (Norrish & Vella-Brodrick 2008), which use a variety of terms and perspectives such as eudaimonic, hedonic and social well-being (Gilbert 2006), psychological or mental well-being (Haver, Akerjordet, Caputi, Furunes and Magee 2015), and flourishing well-being (Seligman 2011). High levels of well-being are related to a better health, more positive relationships and a better response to life events (Michalos, 2014). Now-a-days, well-being is an important principle around the world, so there are wide world efforts to study and measure it (Helliwell, Layard, Sachs and De Neve 2021; UNDP 2021).

## The definition of well-being

An aspect of well-being is the evaluation of subjective experience, which highlights the point of view of the person aside from his/her objective life conditions. This evaluation includes affect and cognitive measures (Diener, Emmons, Larsen and Griffin 1985) related to satisfaction (Diener, Suh and Oishi 1997) and happiness (Michalos 2014; Veenhoven 2008).

Affect measures are the assessment of neurophysiological states known as feelings, which occur in the daily life. These feelings are positive and negative, have a low correlation between them and run independent from each other (Ryff, Lee and Keyes 1995). Positive affect had a moderate to high correlation with well-being (Haver *et al.* 2015; Seligman 2011; Tennant, Hiller, Fishwick, Platt, Joseph, Weich *et al.* 2007). Affect also has activation levels (high or low) and pleasure evaluations (pleas-

ant or unpleasant) (Russell 2003). These states vary through time: a relation which generates a stability through change within these states (Sterling 2004). Both activation levels of affect (high activation: e.g., happiness, enthusiasm; low activation: e.g., calmness, satisfaction) were part of the experience of well-being (Hernández, Basset, Boughton, Schuette, Siu and Moskowitz 2018; Russell 2003).

The cognitive measures include assessments of satisfaction with life as a whole or may evaluate separate areas of life or domains, provided that they have an effect on well-being. The methods to determine the domains related to well-being have several methods: conceptual and philosophical definitions (Rojas 2006); a set defined by a group of experts (Castellanos 2015); or factor analysis techniques (Graham and Lora 2009).

### **Life domains of well-being**

The main domains for Latin America were economic capacity, friends, work, health and housing (Graham *et al.* 2009). In Mexico, the National Institute of Statistics, Geography and Informatics (INEGI) used, as suggested by the Organization for Economic Co-operation and Development (OECD 2021) the domains of leisure time, personal achievements, perspectives of the future, economic situation, work (a work within the labor market), housing, neighborhood, health state, education or instruction acquired, family life, social life, appearance and country one dwells (INEGI 2017). Other studies which inquired into the main well-being domains for Mexicans found seven domains: health, economic, job, family friendship, personal and community environment (Rojas 2006); or thirteen domains: one's economic situation, education, country, city/town where one lives, friends, neighborhood, leisure time available, social life, health, affective or emotional life, work, house and family life (Castellanos 2015).

In sum, well-being is defined as subjective, an affect and cognitive experience and may have salient domains related to health and relationships, especially family, which have proved to be close to well-being (Seligman 2011); work which provides a schedule, identity and status (Zuzaneck and Hilbrecht 2019), a relationship framework which includes social contact, purpose and activity within the community (Karsten, Geithner and Moser 2007), and the means to earn a living and material needs and the planning of a future (Karsten *et al.* 2007; Zuzaneck and Hilbrecht 2019).

### **Semantic networks, cultural relevance and the definition of well-being**

International organizations worldwide defined well-being with a scientific and cross-cultural perspective to help the advancement of society (Helliwell *et al.*

2021; Thinley 2007; UNDP 2021). However, there were concerns about cultural representation of well-being, especially since local communities shape their concepts accordingly (Veenhoven 2012). The measurement of well-being worldwide can be enhanced by considering the local definitions of well-being. Examples of local views and measures of well-being are the Hygge (Biswas-Diener, Vittersø and Diener 2010), Ikigai (Kono and Walker 2015), Rasmia (Merino, Velázquez and Lomas 2020) and Sumak Kawsay (León 2014).

In recent years, the efforts to measure and analyze well-being go across several disciplines and fields of study, such as the neurosciences, psychology, economy, philosophy, to name a few (Norrish and Vella-Brodrick 2008), hence interdisciplinary and multidisciplinary. In consequence, there are several theories and approaches to define and understand well-being (Ballas and Tranmer 2012). A technique that contributes to the study of well-being and its definition is that of semantic networks, since it obtains the mental models, which are basis to the study of the concept representations within the communities (Binder and Schöll 2010). Semantic networks have proved useful since they obtain directly from the target population the data, information that is culturally relevant (Reyes and García y Barragán 2008).

To address the nonlinearity, as well as the cultural issues semantic networks were useful as well as an innovative technique. Semantic networks are also part of the graph theory, within the complex systems study, and may show scale-free, power law distribution and non-linear relations (Canright 2009), since it shows “the shortest path between the vertices [...] the geodesic distance between two vertices is the length in terms of the number of edges of the shortest path between the vertices” (Han, Kamber and Jian 2012). The semantic networks are the participants’ words related to a concept. The sets of words by participant were captured into a matrix, which established the frequency of the word-to-word relations.

As relational systems, graphs that emerge from the semantic networks data have central measures which help establish the relation (edges, link, line) between two elements (nodes, vertex, points), in this paper, words provided by the participants. Statistical features of a graph are related to the nodes (word frequency), to the relation between nodes and to the relations (the path between nodes) among the graph. The main statistical measures are node degree, that measures the frequency of connections between the node of interest with other nodes; the graph diameter which is the maximum number of nodes to cross the graph; path length that represents the number of nodes to go from one node to another (Polanco 2006). These measures are included in other calculations such as betweenness centrality, hub, modularity, and clustering coefficient (Barabási 2021; Li, Alderson, Doyle and Willinger 2005) which were used in this paper.

The betweenness-centrality (b-c) is the frequency of a node of interest within the shortest path of communication between a pair of nodes. The higher the frequency, the more importance it has for the whole graph. Hence the b-c shows the power and control the node has in the whole graph due to its management of the spread of information within the network (Li *et al.* 2005).

A hub is a node with a certain link frequency among nodes in the graph; it represents the interchange and communication for the graph provided by the node (Polanco 2006; Ruelas and Mansilla 2005). So, a hub node connects high b-c nodes to the low degree nodes supporting the structure of the whole graph, (Li *et al.* 2005). The modularity which considers connectivity and density within subgroups of the graph, (modules) along with clustering, provide a view of the subgraph interaction (Albert and Barabasi 2002) and the organization of the whole graph (Ruelas and Mansilla 2005) which attest the presence of the small world phenomenon (Barabási 2021), emergence and self-organization within non-linearity, which is expected in complex social systems, since they are related to collective behavior (Hilbert 2013).

The social sciences aim to understand this collective behavior through the interactions as a whole relational system and understand the relation between variables (Kaplan 2004). These very systems show the mental models generated by cultures (Binder and Shöll 2010). Semantic networks can represent complex systems and may be used to obtain this cultural background of well-being (Vega-Noriega, Pimentel and Batista de Albuquerque 2005).

This method collects the responses with the modified natural semantic networks, developed within ethnopsychometry, to obtain the components (e.g., words) of a given concept. The person is asked to give words related to the concept, which naturally include his/her cultural background. Set into a network, these words are the foundation that gives a connotative definition for the concept. This technique proved useful in the development of instruments like questionnaires, scales and indexes (Reyes and García y Barragán 2008).

In some studies, well-being showed a non-linear behavior (e.g., Campos, Lima, Devlin, and Hernández 2016; Clark and Oswald 2006; González, Coenders, Saez and Casas 2010; Rojas 2006). This meant a non-correspondence between causes and effects (non-linearity), and it had an organization considering interactions within the parts that have effect among them, and that the sum of the parts has other properties leading to non-predictability (González, Coenders and Casas 2008; González, Coenders, Saez and Casas 2010). Semantic networks in graph theory can have an analysis which support the analysis of non-linear phenomenon because it has non-linear relations among nodes, is scale-free and has power law distribution (Canright 2009). Therefore, the networks reflect the importance of a relationship due to connectedness, a salient advantage, since they do not follow the normal distribution principle (Polanco 2006).

The aim of this paper was to know the connotative definition of the concept of well-being and with the obtained definition, to develop an instrument to measure well-being. Therefore, the use of semantic networks technique may address the non-linearity and the cultural concern to obtain a tailored definition of well-being. The first objective of this study was to use semantic networks as an innovative way to obtain a definition of well-being among the targeted population, addressing both the cultural background and the non-linearity of well-being. The second objective was to develop a valid scale to measure well-being in dwellers of Mexico City and its Metropolitan Area.

## Method

This research was a non-experimental, transversal field study. It had two stages, both with quota sampling to match the population proportions within Mexico City (table 1) considering sex and age (table 2). The socioeconomic status (ses) kept a number to allow statistical comparisons among the different groups, although it did not reflect the real proportion of the ses. Mexico City which had 8 million 851 thousand inhabitants, of which 67.7% had 20 years of age or more (INEGI, 2015).

**Table 1.** Proportions of the Mexico City's population.

Mexico City	Men		Women		Age: 20 or more	
8,851,080	2,787,363	31.5%	3,204,781	36.2%	5,992,144	67.7%
Age	%	Proportion	%	Proportion	%	Proportion
20-34	25.1	<b>0.38</b>	24.3	<b>0.35</b>	24.7	<b>0.36</b>
35-49	21.1	<b>0.32</b>	22.0	<b>0.32</b>	21.5	<b>0.31</b>
50 or more	19.7	<b>0.30</b>	23.2	<b>0.33</b>	21.5	<b>0.31</b>
Subtotal %	65.8		69.4		67.7	

Mexico City's population within the economically active people 20 years and older represent the 67.7% of the people who had the legal age to work (15 years or older) and had a paid job.

Source: Own authorship.

The well-being of this group is important since more than 90% within this range are economically active, and have a family life with dependents (children, older adults, sick or disabled people) which rely on their activity and resources, being a main economic support at home. It was observed that well-being decreased among this age range: between 35 and 65 years (Burns 2020) or 40 and 50 (Clark and Oswald 2006). To better characterize the sample, main life events were taken into consideration to subdivide the age range into three groups: 20 to 34, 35 to 49, and 50 and more. This was observed in the Stage 1 and 2 of this study (table 2).

**Table 2.** Sample frequencies and percentages.

Sample	Men	Women	Age	
Age	f	f	f	Proportion
20-34	35	38	73	<b>0.36</b>
35-49	32	33	65	<b>0.32</b>
50 or more	30	33	63	<b>0.31</b>
	97	104	201	1

Age group of the sample had almost the same proportion as the Mexico City's population (see table 1). Source: Own authorship.

### *Stage one*

The sample of 201 included women (52%) and men (48%), 20 years and older (mean = 39.97 years, s.d. = 13.56 years), who must be inhabitants of the Metropolitan Zone of Mexico City (the sample included people from 14 boroughs of Mexico City and 12 municipalities of the State of Mexico), and were volunteers (informed consent, did not receive incentive) (table 3).

The sample was obtained between May and August 2018. The instrument was a modified natural networks technique questionnaire (format as advised by Valdez, 1998). It included a page for each concept to be defined: well-being, happiness, satisfaction, presented in random order. Also, there was a last page to collect socioeconomic data (sex, age, education level, occupation, ses).

Participants were asked to provide five words related to each concept and then, to write the number one to the most related, the number two to the following, assigning a number to each of the words they provided.

Then, the analysis was performed with the Gephi 0.9.1 program to obtain the values of the semantic network as a graph as well as its representation. To perform the graph analysis Gephi 9.1 and subsequent versions are available free at <https://gephi.org/users/download/>.

The words provided by the participant were captured in an Excel format eliminating word repetitions to avoid redundancies since a definition must contain the terms to obtain a complete set of words to be comprehensive and to avoid circularity, allowing interconnection.

Also, it is salient to note that semantic networks technique does not specify and ideal sample size. Although a broad recommendation is to acquire the biggest sample possible, semantic networks showed what was considered a saturation level, which may establish a limit to the data collection (Streiner, Norman and Cairney 2015); reached at the 200 questionnaires.

There was no simplification, nor categorization according to similarity in meanings or concepts. For example, word like sons and my sons remained sepa-

**Table 3.** Samples of the stages.

	Stage 1 N = 201	Stage 2 N = 427
<b>Sex</b>	<b>Percentage</b>	<b>Percentage</b>
Female	51.7	54.8
Male	48.3	45.2
<b>Education level</b>	<b>Percentage</b>	<b>Percentage</b>
Elementary	5.5	5.2
Junior high	14.4	12.9
High school	29.4	40.3
Undergraduate	39.3	36.5
Graduate	11.5	5.2
<b>Age</b>	<b>Percentage</b>	<b>Percentage</b>
20 to 34	36.3	46.4
35 to 49	32.3	34.7
50 or more	31.3	19
Mean	39.13	37.75
S.D.	14.04	12.54
Range	20 to 79	20 to 89
<b>SES</b>	<b>Percentage</b>	<b>Percentage</b>
High	30.8	33.7
Medium	35.3	40.7
Low	33.8	25.5

Samples of the networks and of the participants who responded the questionnaire had percentages similar within age and sex to the ones in Mexico's City population. Other sociodemographic characteristics are provided.

Source: Own authorship.

rate since they represent different meaning units: it is different to talk about having children as part of well-being, than to specify that the element related to well-being is one's own son.

### *Stage two*

The sample of 427 included men (45%) and women (55%) with at least 20 years old (mean = 37.75 years, s.d. = 12.54) volunteers (informed consent, did not receive incentive) inhabitants of the Metropolitan Zone of Mexico City (table 3).

A questionnaire was developed with the former stage's data and had two scales: well-being satisfaction scale and well-being experience scale). The last part was a socioeconomic section for data on sex, age, occupation, education level, and ses. The scales of the questionnaire were validated with Alpha of Cronbach (IBM SPSS Statistics 25) and confirmatory factor analysis (AMOS 24).



## Results

### *Stage one: Semantic networks of well-being*

The nodes of the graph were the words people considered related to the concept of well-being, satisfaction, or happiness. They were put into tables, the spelling was checked, then singular and plural nouns and feminine and masculine nouns and adjectives were merged (when the meaning remained the same).

The well-being graph was constructed with the words for the concepts of well-being, happiness and satisfaction since according to the theory they constitute the entire concept of well-being (Diener *et al.* 1997), and they proved to be relevant to one another. Each of the three concepts had, within the main nodes (higher betweenness-centrality), the other concepts. There was a moderate relation between well-being and happiness (Spearman Rho = 0.541,  $p = 0.002$ ), and, happiness and satisfaction (Spearman Rho = 0.577,  $p < 0.001$ ). Between well-being and satisfaction there was a non-significant low relation (Spearman Rho = 0.251,  $p = 0.216$ ).

In most cases, graphs are free-scale networks, subjected to power law. In consequence, the networks may reflect the importance of a relationship due to connectedness, a salient advantage, since they do not follow the normal distribution principle (Polanco 2006). The directed graph of well-being (nodes = 173, vertex = 1078) resulted in a complex non-linear, free-scale network since it had an average path length of 2.75, a mean degree of 6.231 and a diameter of 6., and emergence with modularity values between 0.26 and 0.48 (table 4). The network had a clustering coefficient of 0.512 which is indicative of a small world phenomenon. In the language of network science six degrees, also called the small world property, means that the distance between any two nodes in a network is unexpectedly small (Barabasi 2021, section 3.8), that considers a low average path length and a high clustering coefficient as an indicative of the small-world phenomena, high clustering coefficient meaning values of  $p$  around 0.5 (box 3.9, Barabasi 2021).

The graph had within the highest degrees the nodes of happiness and satisfaction, which according to the theory, are two of the elements considered to be important in well-being definition and measurement. Also, the cognitive as well as the affective components proposed in the theory were present within the graph. The organization of the graph into modules could be derived into domains of well-being (figure 1).

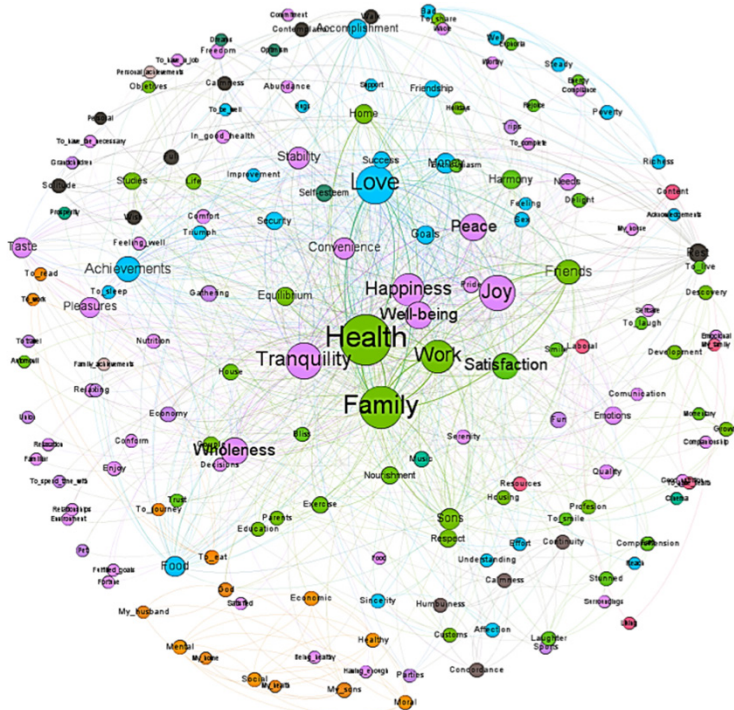
Graphs have a set of nodes or vertex (e.g., the words used to define well-being) and their edges or relationships represent the associations from one node to another. These nodes and edges form groups or communities. The graph may have several communities, which have systematic local density fluctuations, which show the propensity for clustering, that has a coefficient that for well-being was of 0.512.

**Table 4.** Graph measures.

Categories	Nodes	Vertex	Mean path length	Mean clustering coefficient	Mean degree	Modularity
Total	173	1078	2.754	0.512	6.231	0.312
Graph central tendency measures by sample's sex						
Women	85	468	2.462	0.455	5.506	0.265
Men	104	584	2.729	0.668	5.610	0.442
Graph central tendency measures by sample's age group						
20 to 34	59	356	2.402	0.446	6.034	0.299
35 to 49	69	314	2.603	0.599	4.551	0.415
50 and more	77	354	2.862	0.562	4.597	0.481
Graph central tendency measures by sample's ses						
SES high	59	274	2.482	0.414	4.644	0.273
SES medium	58	308	2.365	0.503	5.310	0.308
SES low	59	246	2.399	0.385	4.169	0.337

These are the central tendency measures for each sex, age and ses group within the sample.  
Source: Own authorship.

**Figure 1.** Well-being graph: the size of the node is proportional to its degree.



Source: Own authorship.

The graph had an organization around main nodes, which are the ones with the highest betweenness-centrality (b-c) values, which entail their presence in most of the paths between nodes. Well-being graph had six main nodes: health (b-c value = 9232.71), family (b-c value = 5459.98), tranquility (b-c value = 3990.58), love (b-c value = 3343.42), joy (b-c value = 3259.70) and work (b-c value = 2593.51). Each of them was considered relevant because they had a value of more than the 25% of the value of the main node (health). The figure 1 showed these main nodes in bigger fonts and with more paths towards them: the connections between them and the modules and their nodes in the network. These paths reflect, with their width, frequency of links (e.g., family and work).

Another statistical feature of the graph structure worth to be noted were hubs. Nodes that act as hubs have a high number of links. They have an important role in connectivity within the graph. They are the preferred distribution route, so they distribute information within the paths among nodes including small ones, decreasing the distance between nodes and since hubs enable communication among the graph elements or nodes, they give strength to the structure (Ruelas and Mansilla 2005) also acting as intermediaries among small nodes, small subgraphs, and high centrality nodes (Bertolero, Yeo, Bassett and D'Esposito 2018).

To name the modules of the well-being network they were considered as factors (Qualtrics.com, 2022). And to get an appropriate characterization of a factor definitions were considered to categorize the nodes within the modules. Well-being included words around health, which related to elements that could be associated to the WHO 1977 definition of health “a call for achieving a level of health that would permit everyone to lead a socially and economically productive life, a goal ‘nearer to reality’ “ that permitted to include a wider range of life aspects within health and clarifying the former definition ‘Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity’.” (WHO 2008, 12). Specific to the emotional contents it was considered within the psychological health definition (Huppert and So 2013) that is the expression of positive affect.

The relationships were defined as the one's the person has to people close to them within an emotional and personal context, thus family, friends and the community, that involves participation and development (Montoya, Puerta, Hernández, Páez and Sánchez 2016) due to reciprocity and support (Taniguchi 2015). The resources were considered the abilities, skills, possessions, income and time.

The main hubs to well-being graph were health (hub value = 0.310), love (hub value = 0.267), family (hub value = 0.262), joy (hub value = 0.248, happiness (hub value = 0.236), tranquility (hub value = 0.230), and work (hub value = 0.208),

which were also the highest b-c values (except for happiness). There can be a group of hubs for the graph as well as for subsets (subgraphs) in the graph. These subsets in the graph are nodes that gather clusters of nodes, known as modules.

The graph offered a division of eight modules, and four were discarded to become a domain (modules 3, 4, 5, 7) because they did not have enough nodes to construct a factor, nor they had nodes with b-c values worth considering (less than 0.19 relative value compared to the main b-c value), nor hub values (less than 0.19 hub value) (figure 1). The graph was organized into four main communities: module zero (21.97%), module one (31.21%) module two (35.84%), whose values were considered adequate (Barabási 2021); and module six (2.89%) whose elements had lower values of b-c, hub and clustering, although different from zero, but provided information about time organization which is considered important to well-being (OECD 2021).

Within the module zero there were subgroups about health and resources. Within the module one, there were subgroups about health, relationships, and resources. The module two had subgroups about positive emotions and resources (mainly related to success). The module six was about activities. The modules were worked separately and were assigned a tag considering the nodes within them and matching them with the theory review on domains. Each of these subgroups within the modules had a node with a value different from zero, with at least one hub and three or more nodes to constitute a factor. Then the subgroups were rearranged into domains and subdomains considering their tag, as it will be described in the next paragraphs.

In a more detailed description, the module zero gathered health (e.g., nutrition, exercise), resources (e.g., housing, occupational), and activities (e.g., gathering, to enjoy). The main hub after health (hub value = 0.31) was stability (hub value = 0.16) (table 5). The highest b-c nodes were health (b-c = 9232.71), rest (b-c = 780.04) and food (b-c = 780.04) and for the resources subgraph, studies (b-c = 293.48). This module was mainly about physical health and the material resources and actions towards it.

The module one was associated to positive emotions (e.g., love, affection, sincerity) and individual resources (e.g., success, self-esteem, life). The highest b-c nodes to the subgroups were family (b-c = 5459.98), love (b-c = 3343.32), work (b-c = 2593.51), and money (b-c = 406.70). The main hubs were family (hub = 0.36), love (hub = 0.27), work (hub = 0.21), money (hub = 0.13), and accomplishment (hub = 0.13) (table 6).

The subgroups into this module were about relationships and how we relate to others (e.g., to share, the spend time with), resources either material or about time (e.g., money, profession). Psychological health was observed within the

emotions reported in the nodes (Huppert and So 2013), which were mostly related to an activation state (e.g., enthusiasm, affection). An important node, work, was among the relationships, not within the resources nodes (table 6).

**Table 5.** Values of the graph: module zero.

Module o	b-c	hub	Clustering	Eigencentrality	Domain
Comfort	0.00	0.05	1.00	0.15	Health
Nutrition	0.00	0.03	1.00	0.10	Health
Quality	1.33	0.04	0.80	0.14	Health
Stability	164.72	<b>0.16</b>	0.56	0.50	Health
Equilibrium	109.92	0.10	0.53	0.31	Health
Exercise	37.00	0.05	0.52	0.17	Health
Food	<b>780.04</b>	0.09	0.37	0.29	Health
Rest	<b>1669.45</b>	0.03	0.27	0.11	Health
Health	<b>9232.71</b>	<b>0.31</b>	0.11	1.00	Health
Housing	0.00	0.05	1.00	0.15	Resources
Occupational	0.00	0.03	1.00	0.11	Resources
Resources	0.00	0.03	1.00	0.11	Resources
Economy	6.58	0.08	0.87	0.25	Resources
House	6.30	0.06	0.76	0.20	Resources
Nourishment	38.33	0.07	0.47	0.23	Resources
Trust	0.00	0.04	1.00	0.14	Resources
To enjoy	0.00	0.03	1.00	0.10	Resources
Gathering	13.42	0.07	0.67	0.23	Resources
Studies	293.48	0.06	0.53	0.19	Resources

The words within the same module were classified into to domains according to the definitions of health and resources obtained in the theory review. The concepts with b-c in bold are the most salient to the domain.

Source: Own authorship.

The module two was about positive emotions (e.g. bliss, delight) and accomplishment (e.g. decisions, goals). The emotions here were both about activation (e.g. content, pride) and homeostatic (non-activation) (e.g. wholeness, harmony). The main b-c were tranquility (b-c = 3990.58), joy (b-c = 3259.70), and achievements (b-c = 1030.31). The main hubs were tranquility (hub = 0.23), joy (hub = 0.25), and achievements (hub = 0.16) (table 7). The module mentioned both types of emotions, high and low activation (homeostatic) which were associated to individual or group actions (table 7).

The module six was about actions (e.g., to read, to sleep). The main b-c was to eat (b-c = 329), and the hubs were to read (hub = 0.01) and to journey (hub = 0.01). The module consisted of activities of the day-to-day life (table 8).

**Table 6.** Values of the graph: module one.

Module 1	b-c	hub	Clustering	Eigencentrality	Domain
Sex	0.00	0.05	1.00	0.16	Health
Triumph	0.00	0.04	1.00	0.13	Health
Improvement	0.00	0.04	1.00	0.12	Health
Sincerity	0.00	0.03	1.00	0.10	Health
Affection	0.00	0.03	1.00	0.10	Health
Enthusiasm	0.00	0.03	1.00	0.09	Health
Freedom	7.12	0.07	0.90	0.22	Health
Life	19.71	0.05	0.67	0.16	Health
Self-esteem	655.47	0.07	0.39	0.22	Health
Love	<b>3343.42</b>	<b>0.27</b>	0.19	0.85	Health
To share	1.84	0.02	0.00	0.06	Health
Couple	0.00	0.08	1.00	0.26	Relationships
Parents	0.00	0.03	1.00	0.10	Relationships
Understanding	0.00	0.03	1.00	0.08	Relationships
Education	4.58	0.05	0.83	0.15	Relationships
Friendship	50.03	0.09	0.75	0.29	Relationships
Home	35.44	0.12	0.70	0.39	Relationships
God	292.71	0.03	0.50	0.09	Relationships
Sons	940.28	0.10	0.39	0.32	Relationships
Friends	506.93	0.16	0.37	0.50	Relationships
Work	<b>2593.51</b>	<b>0.21</b>	0.20	0.67	Relationships
My sons	728.45	0.01	0.20	0.05	Relationships
Family	<b>5459.98</b>	<b>0.26</b>	0.13	0.85	Relationships
To spend time with	0.00	0.01	0.00	0.05	Relationships
Pet	0.00	0.01	0.00	0.05	Relationships
Grandchildren	0.00	0.01	0.00	0.05	Relationships
I	0.00	0.03	1.00	0.09	Resources
Objectives	0.00	0.02	1.00	0.07	Resources
Profession	115.17	0.02	0.70	0.07	Resources
Accomplishment	89.83	0.13	0.67	0.41	Resources
Money	<b>406.70</b>	<b>0.13</b>	0.51	0.42	Resources
Respect	142.81	0.08	0.42	0.25	Resources
Automobile	0.00	0.01	0.00	0.05	Resources
Customs	0.00	0.03	1.00	0.10	Resources
Trips	0.00	0.04	1.00	0.14	Resources
Parties	0.00	0.03	1.00	0.10	Resources
Sports	0.00	0.03	1.00	0.09	Resources
Music	324.00	0.06	0.67	0.20	Resources
Fun	126.50	0.07	0.62	0.21	Resources
To travel	0.00	0.01	0.00	0.05	Resources

The words within the same module were classified into to domains according to the definitions of health, relationships and resources obtained in the theory review. The concepts with b-c in bold are the most salient to the domain.

Source: Own authorship.

**Table 7.** Values of the graph: module two.

Module 2	b-c	hub	Clustering	Eigencentrality	Domain
Satisfaction	<b>1514.09</b>	0.18	0.33	0.56	Health
Security	29.17	0.10	0.62	0.32	Health
Convenience	83.77	0.16	0.63	0.51	Health
Pleasures	242.87	0.13	0.57	0.40	Health
Taste	240.49	0.11	0.46	0.35	Health
Harmony	32.85	0.15	0.80	0.46	Health
Pride	14.46	0.07	0.80	0.21	Health
Delight	24.30	0.04	0.67	0.12	Health
Emotions	335.78	0.10	0.64	0.30	Health
Bliss	324.00	0.04	0.50	0.12	Health
Peace	470.52	0.21	0.40	0.65	Health
Content	339.73	0.02	0.30	0.08	Health
Wholeness	1311.11	0.17	0.28	0.53	Health
Happiness	1783.69	0.24	0.27	0.74	Health
Joy	<b>3259.70</b>	<b>0.25</b>	0.22	0.79	Health
Tranquility	<b>3990.58</b>	<b>0.23</b>	0.17	0.73	Health
To laugh	19.05	0.01	0.00	0.05	Health
Decisions	0.00	0.02	1.00	0.07	Resources
Success	11.03	0.09	0.79	0.27	Resources
Needs	7.87	0.09	0.75	0.27	Resources
Goals	439.97	0.09	0.47	0.30	Resources
Achievements	<b>1030.31</b>	<b>0.16</b>	0.33	0.52	Resources

The words within the same module were classified into to domains according to the definitions of health and resources obtained in the theory review. The concepts with b-c in bold are the most salient to the domain.

Source: Own authorship.

**Table 8.** Values of the graph: module six.

Module o	b-c	hub	Clustering	Eigencentrality	Domain
To read	219.80	<b>0.01</b>	0.00	0.05	Resources
To journey	219.80	<b>0.01</b>	0.00	0.05	Resources
To sleep	196.40	0.01	0.33	0.04	Resources
To eat	<b>329.00</b>	0.00	0.00	0.01	Resources
To work	0.00	0.00	0.00	0.00	Resources

The words within the same module were classified into to domains according to the definition of resources obtained in the theory review. The concepts with b-c in bold are the most salient to the domain.

Source: Own authorship.

The tags were gathered into subgroups and gathered under a domain, which were then subdivided into subdomains for the purposes of analysis and compa-



rability. The domain health was divided into physical and psychological health; the domain resources had the subdomains personal, material and time resources; and the domain of relationships had the subdomains family, friends, and community relationships. This final setting was used for the questionnaire discussed in the next section.

### *Stage two: Tailoring an instrument to measure well-being*

Due to the domain arrangement the questionnaire could be tailored according to the theory reviewed for this study and the cultural findings within the semantic networks analysis. The backbone to the scales was the graph findings, but if theory stressed some issue, not addressed in the graph directly, it was included by operationalizing the concept with the nodes that might imply the concept itself (e.g., time resource: node to sleep, node to work, node to eat). There were two scales developed to measure well-being. First a scale of satisfaction with well-being, and the second, about the relation of each element with to well-being. The Scale of Satisfaction with Well-being had twenty-six questions; the Scale of Experiences of Well-being had eighty-three questions. Both scales constituted the questionnaire; the items of each scale were presented in three different orders to prevent effect due to order. Sociodemographic questions were added to consider sex, age, education, occupation, and sex with the Mexican Association of Market Intelligence and Public Opinion Agencies Index (AMAI index 8x7) (Asociación Mexicana de Agencias de Inteligencia de Mercado y Opinión 2013; López 2008). In this second stage.

### Domains and subdomain in the scales

The first domain was health, which considered the self-report of the participant about his/her physical health and psychological health related to each of the items. Physical health included nutrition, mobility, sleep and nourishment quality, and alcohol intake. The psychological health included the functioning with themselves and others, and the everyday life which were found to be highly correlated to well-being, and positive emotions considering they have a moderate to high relation to well-being (Huppert and So 2013), as opposed to negative emotions which did not show a significant statistical relation (Haver *et al.* 2015; Tennant *et al.* 2007).

The second domain included the relationships with the family, the friends, and the community. The three groups were considered important, and the graph showed their salience to the concept of well-being. Such groups support the person and were key to enhance the life experiences (Montoya, Puerta, Hernández, Páez and Sánchez 2016), and provided support and reciprocity which should be framed within justice, and respect allowing trust and an interchange between



equals (Hawthorne 2006; Taniguchi 2015). Within this frame the nodes such as “respect”, “freedom” and “companionship” were taken into consideration. But the word reciprocity was not included directly into the graph, so it was stated in the items “give love” and “receive love”, and in the three groups of relationships about “what I give” and “what I contribute” and “I feel accepted”, the two latter related to psychological health (Ryff *et al.* 1995). The theory showed the effect on well-being when there is a positive communication and recognition (Ryan and Deci 2001) and a constructive bonding (Seligman 2011). Community was not directly mentioned, but it was included using the nodes which implied community context. From the three nodes (family, friends, community), family had the higher b-c and hub values. Since there are many types of families and couple relationships the concept family was asked considering it grouped members of the household kin related or not (INEGI 2021).

The resources domain included the personal resources such as skills and abilities in which a person grows his/her potential; material resources which include money, material conditions. Elements about facilities and services were included due to the contribution they have according to capabilities approach (Nussbaum 2003); and time resources related to occupation, work, and leisure time, indirectly mentioned in the graph, and included due to the theoretical importance (OECD 2021). Salient nodes to resources domain, material ones, were money and economy along with the house (hub value). This domain included personal resources (cluster and eigenvalues) about housing, occupational, studies, decisions, objectives, and achievements. The time resources included elements related to daily life and activities, such as node music, read and travel, with fun, trips, travel, party, sports grouped in the set.

The sample gathering took into consideration sex and age (Archer, Lim, Teh, Chang & Chen 2015; Burns 2020; Clark & Oswald 2006; López, Møller and Sousa-Poza 2013; Switech and Easterlin 2018), because they have a relevance in the measurement of well-being and quality of life (Ahn, García and Jimeno 2009; Michalos 2014). These variables gave context to the characteristics and had the purpose to guarantee the resemblance of the sample quotas considering the same proportions as the ones in the targeted population. To allow statistical analysis to compare among groups, the sex representation had similar percentages in the three levels, even though the population had more low and less high sex percentages.

### *Validation of the scales*

*Scale of satisfaction with well-being.* It consisted of twenty-six self-report questions about the elements taken from the domains and subdomains of the graph (physical health, psychological health, family, friends and community relation-

ships, and personal, material and time resources) of well-being. The instruction was to determine how satisfied the person was with the mentioned element and assign a value within a Likert scale from none (1) to totally satisfied (4).

*Scale of experiences of well-being.* It consisted of 83 self-report questions about the elements taken from the domains and subdomains of the graph (physical health, psychological health, family, friends, and community relationships and personal, material and time resources) of well-being. The instruction was to determine if their well-being was due to the mentioned element and assign a value within a Likert scale from totally disagree to totally agree.

The means of both scales showed an adequate range of elections for the response options (Table 9). In the scale of satisfaction of well-being the mean was above the arithmetic mean by less than one standard deviation skewness was -0.392 and kurtosis 0.302. The scale of experiences of well-being by domains remained within the 1 standard deviation. Within the subdomains, all values of skewness were less than +/-0.7 and the kurtosis values were less than +/- 2. The whole scale had a value of skewness of -0.544, and of kurtosis 1.631. By domain health skewness was -0.672, and of kurtosis 1.677, relationships skewness was -0.248, and of kurtosis 0.593 and resources skewness was -0.431, and of kurtosis 1.124.

**Table 9.** Means of the sample for the satisfaction scale, the well-being scale and its dominions.

Variable	Mean	S.D.	Range	Min	Max	Scale min.	Scale max.
Satisfaction	76.16	11.19	71	33	104	26	104
Well-being	251.58	33.88	224	103	327	83	332
Health	128.17	17.18	113	49	162	41	164
Relationships	40.88	6.53	41	15	56	14	56
Resources	82.53	12.47	82	28	110	28	112

Central tendency measures for the questionnaire by domain.

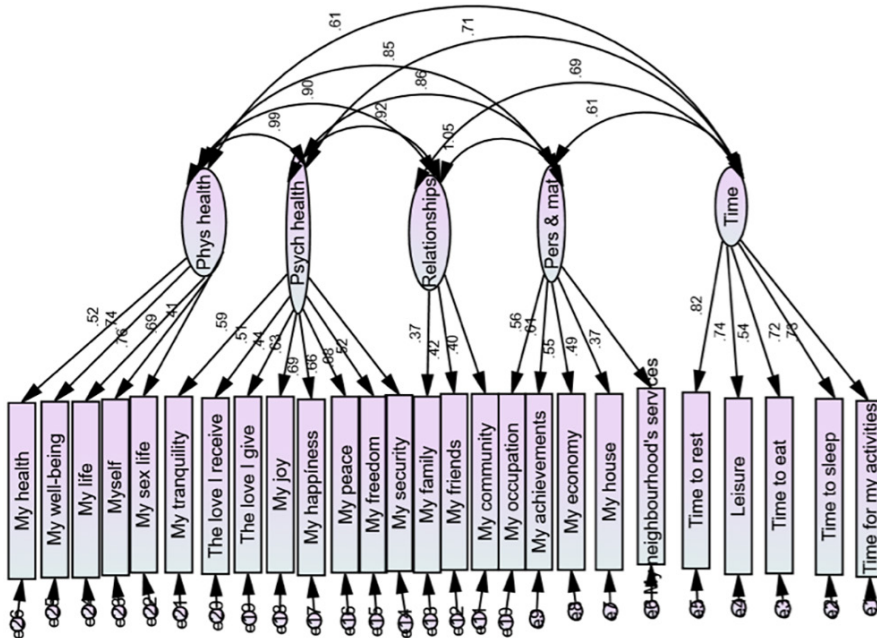
Source: Own authorship.

The scale of satisfaction with well-being had twenty-six questions about the three domains: health (physical and psychological health, emotions); relationships (family, friends, and community relationships); resources (personal, material and time resources). It obtained a Cronbach Alpha of 0.912.

By sex it had 0.906 males and 0.916 for females; by age the values were 20-34 years  $\alpha = 0.926$ , 35-49 years  $\alpha = 0.897$  and for 50 or more years  $\alpha = 0.898$ ; by ses high had  $\alpha = 0.923$ , middle had  $\alpha = 0.918$  and low had  $\alpha = 0.880$ . The confirmatory factor analysis showed a Chi square = 911.336,  $df = 289$ ,  $p < .001$ ,  $\alpha = 0.912$ ,  $k = 26$ ,  $RMSEA = 0.071$ ,  $CFI = .082$  (figures 2 and 3). The satisfaction scale showed no differences between sex ( $t = 1.119$ ,  $gl = 425$ ,  $p = 0.264$ ), nor age ( $F[2,424] = 0.718$ ,  $p = 0.488$ ), nor ses ( $F[2,424] = 1.683$ ,  $p = 0.187$ ).

The scale of experiences of well-being had eighty-three items into the health domain (physical and psychological health which included emotions forty-one items), relationships (fourteen items about family, friends, and community) and resources (twenty-eight items about personal, material and time). It was forced into three factors and had a Cronbach's alpha of 0.969, which showed some redundancy within the items. By sex it had a Cronbach's alpha for male sample of  $\alpha = 0.936$  and,  $\alpha = 0.973$  for female; by age 20-34  $\alpha = 0.969$ , 35-49  $\alpha = 0.968$  and 50 or more years  $\alpha = 0.972$ ; and by ses high level had  $\alpha = 0.968$ , middle  $\alpha = 0.974$  and low  $\alpha = 0.959$ .

**Figure 2.** Confirmatory factor analysis of the scale of satisfaction with well-being.

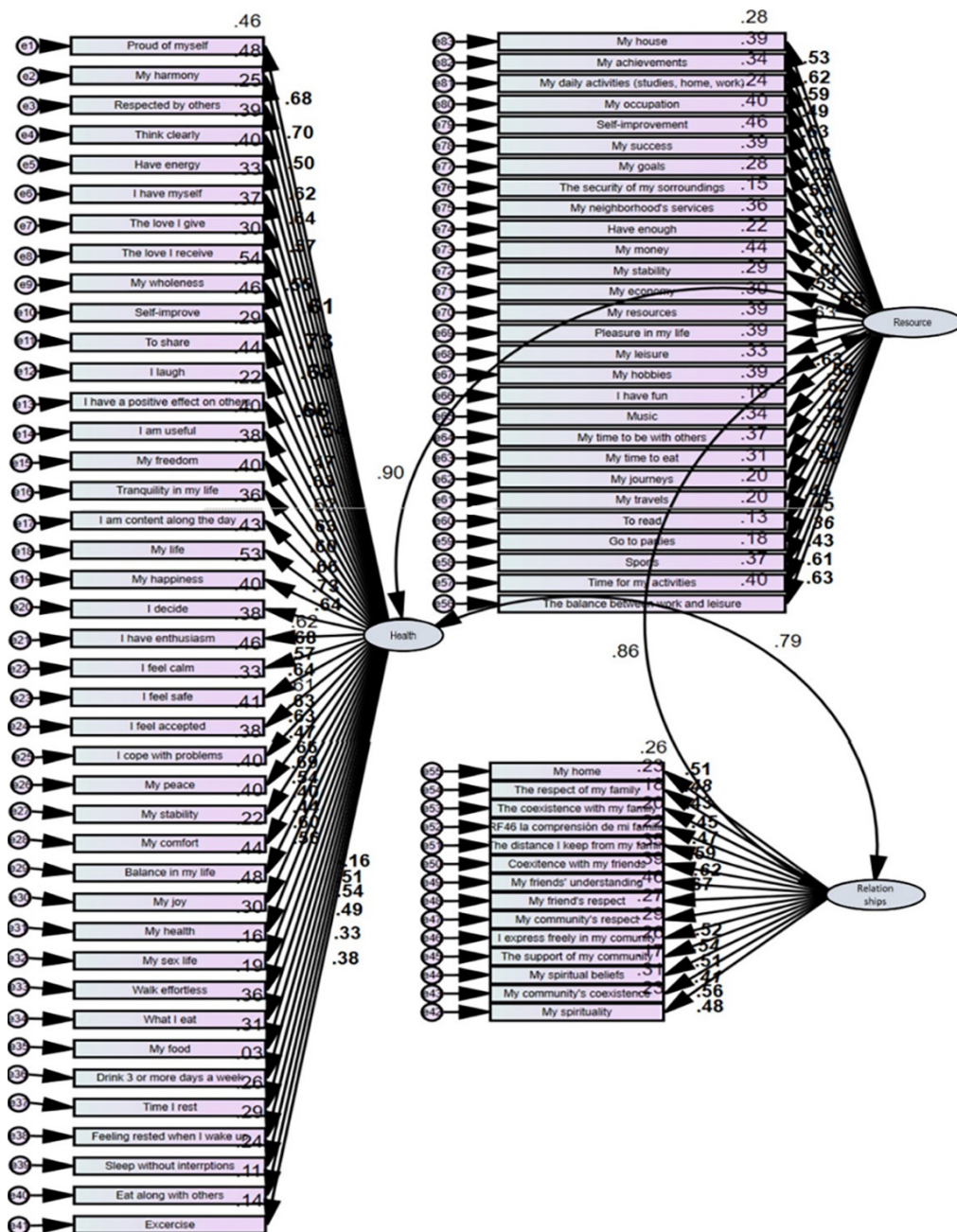


Source: Own authorship.

There were two items with low Cronbach's alpha. But when taken out of the scale the internal consistency showed no changes: "consume of alcohol three or more times a week" and "keep a healthy distance from my family".

The confirmatory factor analysis showed Chi squared = 9062.419,  $df = 3317$ ,  $p < .001$ ,  $\alpha = 0.969$ ,  $k = 26$ , and  $RMSEA = 0.064$ ,  $CFI = 0.670$  (figure 2). The well-being scale showed no differences between sex ( $t = -0.861$ ,  $gl = 425$ ,  $p = -0.389$ ), age ( $F[2,424] = 1.818$ ,  $p = 0.164$ ), nor ses ( $F[2,424] = 0.833$ ,  $p = 0.436$ ).

Figure 3. Confirmatory factor analysis of the scale of experiences of well-being.



Source: Own authorship.

## Discussion

The modified natural semantic networks technique allowed to obtain directly from the target population the elements they considered to be related to their well-being. This technique proved to be a good resource to gather the cultural background of well-being directly from the sample.

Comparing and contrasting the graph results to the theory, the elements of well-being, happiness, and satisfaction, proved to be salient to the concept of well-being. Also, the affect and cognitive components were corroborated. Well-being for Mexican dwellers of the Metropolitan Zone of Mexico City was defined as the experience assessed both by affective and cognitive values within health, both physical and psychological, relationships which included family, friends and community, and resources, including personal, material and those of time.

The graph theory provided the betweenness-centrality and hub values within the well-being concept: the interactions were established within a nonlinear frame. The modularity and clustering gave a full description into each of the sets of well-being that helped construct the domains. The clustering coefficient determined the existence of the small world phenomenon (Barabási 2021). The most important elements that hold the control within the graph and that give strength to the structure and facilitate the communication (Albert and Barabási 2002) were the main b-c and hubs nodes health, love, family, joy, happiness, tranquility, and work. These nodes had a central role in the organization of the modules and then, in the domains and subdomains. So, well-being, as the product of a complex social system, had the emergence, small world phenomenon and non-linearity which also reflected the Mexican cultural background.

According to theory well-being included satisfaction and happiness (Diener *et al.* 1985; Diener *et al.* 1997), and there was a moderate relation between well-being and happiness, and, happiness and satisfaction. When operationalized, the theory proved to complement the definition of well-being and gave a sound foundation and guidance in the organization of the findings of the graph and when necessary, the addition of elements to assess well-being.

The elements related to well-being which were implied in the graph nodes were time and affect organization. Also, the nourishment had to be arranged into qualified concepts (e.g., sleep well, the love I give and the love I receive, balance between work and leisure) to have a better way to ask them into an item. This was also true for the affects included in the questionnaire. Other elements such as alcohol intake, distancing from the family, reciprocity, community, and leisure were included as concepts from the theory due to the relevance for the health and well-being and operationalized with the nodes that might imply them.

As shown in other studies, the emotions related to well-being were positive alone. And among these positive emotions there were two kinds: homeostatic



and activation. This could be explained by the necessity to have an equilibrium in the changes between the activation and the homeostatic emotions. It is important to consider that sustaining an emotion needs an energy consumption, that is difficult by itself to sustain in long periods; the person needs to have periods in which to recuperate such energy (Tennant *et al.* 2007; Huppert and So 2013; Lazić, Gavrilov-Jerković and Jovanović 2019; Sterling 2004).

The work proved to have a salient role in the relationships, as well as to the obtention of material resources and the organization of time (Zuzaneck and Hilbrecht 2019). And it was important to consider that it had different places among the age groups within the interaction with health, the family and the friends.

The graph showed only positive emotions, though, there were two types that have been recognized in other studies: activation and homeostatic (Hernández *et al.* 2018). There could be a relation between such types of affects that could relate to a cycle, as proposed within the allostasis, in which the stability is maintained through the alternation of states (Sterling 2004). Within the graph there were affects that involve more activity such as joy, enthusiasm, or happiness; and there were affects about a low activation, a homeostatic state, such as tranquility, equilibrium, comfort, peace, calmness, or harmony.

The family concept was understood as such even though the different types of families are numerous (e.g., non-kin families, kin families, nuclear families, with only one parent, extended families, compound —non-kin members along with the nuclear family) (INEGI 2021).

There was a node also relevant within the relationships: work. Work was closely related to health and to relationships in the graph. The later was observed in other studies as part of the ways one relates to others, along with being related to the means of earning a living and an activity within a person's time (Karsten *et al.* 2007; Zuzaneck and Hilbrecht 2019). Nevertheless, since work has a main purpose of providing and sustaining a living and is the source of material resources, it was considered among the resources domain. In the graphs, analysis by sex showed that men consider family, friends and work directly related to health and to well-being; women only considered family and work. By age, people under 34 years considered friends and family as mediators for work, and people 35 years and older related work directly to health and to well-being. So, it is important to acknowledge that work addresses several life areas.

As such, time was not mentioned in the graph as well as time resources were not expressed in the graph as such, but from the theory it was considered important as an element that enables entertainment and rest, and the expression of the individual. Leisure, hobbies, and free time were not included in the final graph due to their low or inexistent mentions. But this concept was relevant especially concerning both health, the development of a healthy life plan which

includes a wider range of activities and interests, and to health both physical and psychological since it enhances the expression and growth in other life areas (Nussbaum, 2003).

The scales were adequate considering sex, age and ses comparisons, so they could be useful for a wide variety of samples. There were two items that showed a low internal consistency, though eliminating them did not improve the questionnaires Cronbach's alpha. One of these items, alcohol intake, might have been confusing since there are both positive and negative connotations. There was evidence of alcohol intake contribution to people's health or as part of the activities related to socializing (Kaczmarek, Enko, Awdziejczyk, Hoffmann, Białobrzaska, Mielniczuk and Dombrowski 2016) with both positive (Maccagnan, Taylor and White, 2020; Méjean, Traissac, Eymard-Duvernay, Ati, Delpeuch, and Maire 2007) and negative effects (Telumbre, López, Peralta, Velázquez, Torres and Esparza 2018) especially in Mexican population (Fuentes 2014; Guillén 2012).

The other item, keeping a healthy distance from my family, was understood on a negative connotation by Mexican culture standards, as shown by the graph, which associated happiness with several social interactions. It was worth noting that the responses were collected before the COVID-19 pandemic, so it had a purely social frame, and not the sanitary context it has since 2020 and 2021. And, due to both items considered negative by the respondents of the questionnaire and due to being considered inverted to the rest of the items, they were responded without ease, a phenomenon regarded in other studies (Tennant *et al.* 2007; Winefield *et al.* 2012). Nevertheless, they were left in the scale due to the findings in the theory review and the lack of effect if left out.

## Conclusion

In conclusion, semantic networks analyzed through graph theory were useful to provide the necessary elements and guidance to obtain a definition that took into consideration the non-linearity of the phenomenon. Also, it addressed a cultural concern, providing a way to obtain, directly from the people the characteristics and elements of well-being for inhabitants of Mexico City. In consequence, the scale of satisfaction with well-being and the scale of experiences of well-being had an adequate reliability and validity to measure and study well-being.

### *Limitations*

The sample size that remained when analyzed by sex, age and, ses was enough for a statistical analysis, though it was not a representative number for each of the subgroups. Even though there are still no clear limitations into the sample size for graphs and confirmatory factor analysis a thumb rule would be to col-

lect a big sample, especially for the latter. In this regard, results should be considered with caution. The n for each group allowed comparisons within the category of sex and age, it is considered that sex comparisons might need a bigger sample to prove ascertain the saturation and the actual representation of the cultural connotation for the low socioeconomic status, which was underrepresented.

In the stage two, linearity might have hindered some of the relations between variables and subdomains when corroborating the reliability and validity of the scales in the questionnaire.

Also, there are other small groups within the population that might have been misrepresented, and that would benefit from and contribute to a better well-being definition and understanding. ■

## References

- Ahn, Namkee, Juan Ramón García, and Juan Francisco Jimeno. 2009. *The impact of unemployment on individual well-being in the EU*. 23 pp. <http://www.ENE-PRI.org>. ISBN 92-9079-509-3.
- Albert, Reka, and Albert-László Barabási. 2002. Statistical mechanics of complex networks. *Reviews of Modern Physics*, 74: 47-97. <https://doi.org/10.1103/RevModPhys.74.47>.
- Archer, Jo. A., Z. M. Tony Lim, Hui Chian Teh, Weining C. Chang, and S. H. Annabel Chen. 2015. The effect of age on the relationship between stress, well-being, and health in a Singaporean sample. *Ageing International*, 40: 413-425. <https://doi.org/10.1007/s12126-015-9225-3>.
- Asociación Mexicana de Agencias de Inteligencia de Mercado y Opinión. 2013. *Índice de niveles socioeconómicos*. <https://www.amai.org/NSE/>.
- Ballas, Dimitris, and Mark Tranmer. 2012. Happy places? A multilevel modeling approach to the analysis of happiness and well-being. *International Regional Science Review*, 35: 70-102. <https://doi.org/10.1177/0160017611403737>.
- Barabási, Albert-László. 2021. *Network science*. <http://networksciencebook.com/>.
- Bertolero, Maxwell, A., B. T. Thomas Yeo, Danielle S. Bassett, and Mark D'Esposito. 2018. A mechanistic model of connector hubs, modularity, and cognition. *Nature Human Behaviour*, 1-19. <https://doi.org/10.1038/s41562-018-0420-6>.
- Binder, Claudia R., and Regina Schöll. 2010. Structured mental model approach for analyzing perception of risks to rural livelihood in developing countries. *Sustainability*, 2: 1-29. <https://doi.org/10.3390/su2010001>.
- Biswas-Diener, Robert, Joar Vittersø, and Ed Diener. 2010. The Danish effect: beginning to explain high well-being in Denmark. *Social Indicators Research*, 97: 229-246. <https://doi.org/10.1007/s11205-009-9499-5>.



- Burns, Richard A. 2020. Age-related differences in the factor structure of multiple wellbeing indicators in a large multinational European survey. *Journal of Happiness Studies*, 21: 37-52. <https://10.1007/s10902-019-00077-y>.
- Campos, Cláudia, Maria Luísa Lima, Ann Sloan Devlin, and Bernardo Hernández. 2016. Is it the place or the people? Disentangling the effects of hospitals' physical and social environments on well-being. *Environment and Behavior*, 48(2): 299-323. <https://doi.org/10.1177/0013916514536182>.
- Canright, Geoffrey. 2009. Complex networks and graph theory. In E. Meyers (Ed.), *Encyclopedia of complexity and systems science*. New York, NY.: Springer. [https://doi.org/10.1007/978-0-387-30440-3\\_83](https://doi.org/10.1007/978-0-387-30440-3_83).
- Castellanos, Roberto. 2015. *Encuesta nacional sobre satisfacción subjetiva con la vida y la sociedad ENSAVISO*. Presented February 5th, in the Institute of Social Investigation. <http://78.41.128.109/images/Presentaci%C3%B3n-ENSAVISO.pdf>.
- Clark, Andrew. E., and Andrew J. Oswald. 2006. *The curved relationship between subjective well-being and age*. Working paper No. 2006-29, JEL Codes: C23, I31, J10. Paris, France: Paris-Jourdan Sciences Economiques. <https://halshs.archives-ouvertes.fr/halshs-00590404/document>.
- Diener, Ed, Robert A. Emmons, Randy Larsen, and Sharon Griffin. 1985. The satisfaction with life scale. *Journal of Personality Assessment*, 49(1): 71-75.
- Diener, Ed, Eunkook Suh y Shigehiro Oishi. 1997. Recent findings on subjective well-being. *Indian Journal of Clinical Psychology*, 24(1): 25-41. [https://intranet.newriver.edu/images/stories/library/Stennett\\_Psychology\\_Articles/Recent%20Findings%20on%20Subjective%20Well-Being.pdf](https://intranet.newriver.edu/images/stories/library/Stennett_Psychology_Articles/Recent%20Findings%20on%20Subjective%20Well-Being.pdf).
- Fuentes, Mario Luis. 2014. México social: alcoholismo un peligro creciente. *Excelsior*, January 7. <https://www.excelsior.com.mx/nacional/2014/07/01/968321>.
- Gilbert, Daniel. 2006. *Stumbling on happiness*. New York: A. A. Knopf. ISBN: 9781400042661.
- González, Mónica, Ferrán Casas, and Germán Coenders. 2007. A complexity approach to psychological well-being in adolescents: major strengths and methodological issues. *Social Indicators Research*, 80: 267-395. <https://doi.org/10.1007/s11205-005-5073-y>.
- González, Mónica, Germán Coenders, and Ferrán Casas. 2008. Using non-linear models for a complexity approach to psychological well-being. *Quality y Quantity*, 42, 1-21. <https://doi.org/10.1007/s11135-006-9032-8>.
- González, Mónica, Germán Coenders, Marc Saez, and Ferrán Casas. 2010. Non-linearity, complexity and limited measurement in the relationship between satisfaction with specific life domains and satisfaction with life as a whole. *Journal of Happiness Studies*, 11: 335-352. <https://doi.org/10.1007/s10902-009-9143-8>.

- Graham, Carol, and Eduardo Lora (eds.). 2009. *Paradoxes and perspectives in quality of life*. Washington: The Brookings Institution. ISBN: 9780815703266.
- Guillén, Patricia. 2012. Las cifras de alcoholismo en México. *Animal Político*, March 3. <https://www.animalpolitico.com/2012/03/las-cifras-del-alcoholismo-en-mexico/>.
- Han, Jiawei, Micheline Kamber, and Jian Pei. 2012. 11 – Advanced cluster analysis. In *The Morgan Kaufmann series in data management systems, data mining*. Third ed., 497-541. <https://doi.org/10.1016/B978-0-12-381479-1.00011-3>.
- Haver, Annie, Kristin Akerjordet, Peter Caputi, Trude Furunes, and Christopher Magee. 2015. Measuring mental well-being: a validation of the short Warwick-Edinburgh mental well-being scale in Norwegian and Swedish. *Scandinavian Journal of Public Health*, 43: 721-727. <https://doi.org/10.1177/1403494815588862>.
- Hawthorne, Graeme. 2006. Measuring social isolation in older adults: development and initial validation of the friendship scale. *Social Indicators Research*, 77: 521-548. <https://doi.org/10.1007/s11205-005-7746-y>.
- Helliwell, John F., Richard Layard, Jeffrey D. Sachs, Jan-Emmanuel De Neve, Lara B. Aknin, and Shun Wang (eds.). 2021. *World happiness report 2021*. New York: Sustainable Development Solutions Network. <http://worldhappiness.report/>.
- Herder Editorial. 2017. *Encyclopaedia Herder*. [https://encyclopaedia.herdereditorial.com/wiki/Definici%C3%B3n,\\_reglas\\_de\\_la](https://encyclopaedia.herdereditorial.com/wiki/Definici%C3%B3n,_reglas_de_la). (Retrieved, May 30, 2023).
- Hernández, Rosalba, Sarah M. Basset, Seth W. Boughton, Stephanie A. Schuette, Eva W. Siu, and Judith T. Moskowitz. 2018. Psychological well-being and physical health: associations, mechanisms, and future directions. *Emotion Review*, 10(1): 18-29. <https://doi.org/10.1177/1754073917697824>.
- Hilbert, Martin. 2013. *1 CCSSCS: Introducción y características de los sistemas complejos sociales*. [https://www.youtube.com/watch?v=c6\\_K\\_tOLLwvyl&list=PLazGm-TmJ6iQidzEco7CgHIFjoNCZvH8E](https://www.youtube.com/watch?v=c6_K_tOLLwvyl&list=PLazGm-TmJ6iQidzEco7CgHIFjoNCZvH8E). (Retrieved, June 20, 2022).
- Huppert, Felicia A. and Timothy T. C. So. 2013. Flourishing across Europe: application of a new conceptual framework for defining well-being. *Social Indicators Research*, 110(3): 837-861. <https://doi.org/10.1007/s11205-011-9966-7>.
- Instituto Nacional de Estadística Geografía e Informática (INEGI). 2015. *Beta INEGI, bases de datos*. <http://www.beta.inegi.org.mx/proyectos/registros/vitales/>.
- Instituto Nacional de Estadística Geografía e Informática (INEGI). 2017. *Mide tu bienestar*. <http://www3.inegi.org.mx/sistemas/midetubienestar/>.
- Instituto Nacional de Estadística Geografía e Informática (INEGI). 2021. *Hogares*. <http://cuentame.inegi.org.mx/poblacion/hogares.aspx?tema=P>.
- Kaczmarek, Lukasz, Jolanta Enko, Malgorzata Awdziejczyk, Natalia Hoffmann, Natalia Biolobrzaska, Przemyslaw Mielnoczek, and Stephan Dombrowski.

2016. Would you be happier if you looked better? *Journal of Happiness Studies*, 17: 357-365. <https://doi.org/10.1007/s10902-014-9598-0>.
- Kaplan, David W. 2004. *The SAGE handbook of quantitative methodology for the social sciences*. Madison, WS: The Sage Research Handbooks. ISBN: 0761923594.
- Karsten, I. Paul, Eva Geithner, and Klaus Moser. 2007. A test of Jahoda's latent deprivation model with persons who are out of the labor force. In A. Abele-Brehm, R.T. Riphahn, K. Moser and C. Schnabel (eds.), *LASER Discussion Papers. Paper No. 9*. <http://www.laser.uni-erlangen.de/papers/paper/20.pdf>.
- Kono, Shintaro y Gordon J. Walker. 2020. Theorizing *Ikigai* or life worth living among Japanese university students: a mixed-methods approach. *Journal of Happiness Studies*, 21: 327-355. <https://doi.org/10.1007/s10902-019-00086-x>.
- Lazić, Milica, Vesna Gavrilov-Jerković, and Veljko Jovanović. 2019. The moderating role of trait affect in the relationship between negative life events and life satisfaction. *Journal of Happiness Studies*, 20: 2251-2267. <https://doi.org/10.1007/s10902-018-0050-8>.
- León, M. 2014. *Buen vivir en el Ecuador del concepto a la medición Libro metodológico del Instituto Nacional de Estadística y Censos*. <https://www.ecuador-encifras.gob.ec/documentos/web-inec/Sitios/LIBRO%20buen%20vivir/files/assets/basic-html/page3.html>.
- Li, Lun, John C. Doyle, Walter Willinger, and David Alderson. 2005. Towards a theory of scale-free graphs: definition, properties, and implications. *Internet Mathematics*, 2(4): 431-523. <https://doi.org/10.1080/15427951.2005.10129111>.
- López, Heriberto. 2008. *Nivel socioeconómico AMAI*. <http://www.inegi.org.mx/rne/docs/pdfs/mesa4/20/heribertolopez.pdf>.
- López, Beatriz Fabiola, Valerie Møller, and Alfonso Sousa-Poza. 2013. *How does subjective well-being evolve with age? A literature review*. IZA Discussion Paper No. 7328, April. <http://ftp.iza.org/dp7328.pdf>.
- Maccagnan, Anna, Tim Taylor, and Mathew P. White. 2020. Valuing the relationship between drug and alcohol use and life satisfaction: findings from the crime survey for England and Wales. *Journal of Happiness Studies*, 21: 877-898. <https://doi.org/10.1007/s10902-019-00110-0>.
- Merino, Ma. Dolores, Marta Velázquez y Tim Lomas. 2020. An exploration of the Spanish cultural term *rasmia*: a combination of eagerness, strength, activeness, courage, tenacity and gracefulness. *Journal of Happiness Studies*, 21: 693-707. <https://doi.org/10.1007/s10902-019-00104-y>
- Michalos, Alex. C. (Ed.). 2014. *Encyclopedia of quality of life and well-being research*. <https://doi.org/10.1007/978-94-007-0753-5>.
- Méjean, Caroline, Pierre Traissac, Sabrina Eymard-Duvernay, Jalila El Ati, Francis Delpuech y Bernard Maire. 2007. Influence of socio-economic and lifestyle factors on overweight and nutrition-related diseases among Tunisian mi-

- grants versus non-migrant Tunisians and French. *BMC Public Health*, 7: 1-11. <https://doi.org/10.1186/1471-2458-7-265>.
- Montoya, Erika María, Eneida Puerta, Dora María Hernández, Esteban Páez, and Isabel Cristina Sánchez. 2016. Disponibilidad y efectividad de relaciones significativas: elementos claves para promover resiliencia en jóvenes. Artículos especiales originales. *Índex de Enfermeria*, 25(1-2): 22-26. [https://scielo.isciii.es/scielo.php?script=sci\\_arttext&pid=S1132-12962016000100006](https://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1132-12962016000100006).
- Ng, Weiting, and Ed Diener. 2014. What matters to the rich and the poor? Subjective well-being, financial satisfaction, and postmaterialist needs across the world. *Journal of Personality and Social Psychology*, 107(2): 326-338. <https://doi.org/10.1037/a0036856>.
- Norrish, Jacolyn M., and Dianne A. Vella-Brodrick. 2008. Is the study of happiness a worthy scientific pursuit? *Social Indicators Research*, 87: 393-407. <https://doi.org/10.1007/s11205-007-9147-x>.
- Nussbaum, Martha. 2003. Capabilities as fundamental entitlements: sen and social justice. *Feminist Economics*, 9(2-3): 33-59. <https://doi.org/10.1080/1354570022000077926>.
- Organisation for Economic Co-operation and Development (OECD). 2021. *Más información sobre la OCDE*. <https://www.oecdbetterlifeindex.org/#/111111111111>. (Retrieved, January 2, 2021).
- Polanco, Xavier. 2006. Análisis de redes: introducción. In M. Albornoz y C. Alfaraz (Eds.), *Redes de conocimiento: construcción, dinámica y gestión*. RICYT/CYTED/UNESCO, 77-112. ISBN-10: 987988311X.
- Qualtrics.com. 2022. *What is factor analysis and how does it simplify research findings?* <https://www.qualtrics.com/experience-management/research/factor-analysis/> (Retrieved, November 30, 2022).
- Reyes, Isabel and Luis Felipe García y Barragán. 2008. Procedimiento de validación psicométrica culturalmente relevante: un ejemplo. *Psicología social en México*, XII: 625-630. México: AMEPSO. ISBN 9685411123.
- Rojas, Mariano. 2006. Life satisfaction and satisfaction in domains of life: is it a simple relationship? *Journal of Happiness Studies*, 7: 467-497. <https://doi.org/10.1007/s10902-006-9009-2>.
- Ruelas, Enrique, and Ricardo Mansilla (Coords.). 2005. *Las ciencias de la complejidad y la innovación médica*. México: Universidad Nacional Autónoma de México, Secretaría de Salud y Plaza y Valdés, S. A. de C. V. ISBN 970-722-437-1.
- Russell, James A. 2003. Core affect and the psychological construction of emotion. *Psychological Review*, 110(1): 145-172. <https://doi.org/10.1037/0033-295X.110.1.145>.
- Ryan, Richard M., and Edward L. Deci. 2001. On happiness and human potentials:

- a review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology*, 52: 141-166. <https://doi.org/10.1146/annurev.psych.52.1.141>.
- Ryff, Carol D., and Corey Lee M. Keyes. 1995. The structure of psychological well-being revisited. *Journal of Personality and Social Psychology*, 69(4): 719-727. <https://doi.org/10.1037/0022-3514.69.4.719>.
- Seligman, Martin. 2011. *Flourish: a visionary new understanding of happiness and well-being*. New York: Free Press. ISBN: 9781439190753.
- Sterling, Peter. 2004. *Principles of allostasis: optimal design, predictive regulation, pathophysiology and rational therapeutics. Allostasis, homeostasis, and the costs of physiological adaptation*. Cambridge University Press. <https://doi.org/10.1017/CBO9781316257081.004>.
- Streiner, David L., Geoffrey R. Norman, and John Cairney. 2015. *Health measurement scales: a practical guide to their development and use*. Oxford University Press.
- Taniguchi, Hiromi. 2015. Interpersonal mattering in friendship as a predictor of happiness in Japan: the case of Tokyoites. *Journal of Happiness Studies*, 16: 1475-1491. <https://doi.org/10.1007/s10902-014-9570-z>.
- Telumbre, Juan Yovani, Manuel Antonio López, Laura Edith Peralta, Oscar David Velázquez, Reina Torres, and Santiago Enriqueta Esparza. 2018. Relación del malestar emocional y el consumo de alcohol en adolescentes. *Journal Health NPEPS*, 3(1): 38-50. <https://doi.org/10.30681/252610102758>.
- Tennant, Ruth, Louise Hiller, Ruth Fishwick, Stephen Platt, Stephen Joseph, Scott Weich, Jane Parkinson, Jenny Secker, and Sarah Stewart-Brown. 2007. The Warwick-Edinburgh mental well-being scale WEMWBS: development and UK validation. *Health and Quality of Life Outcomes*, 5(63): 1-13. <https://doi.org/10.1186/1477-7525-5-63>.
- Thinley, Jigme Y. 2007. *What is gross national happiness?* Switzerland: United Nations. <http://www.bhutanstudies.org.bt/publicationFiles/ConferenceProceedings/RethinkingDevelopment/4.Re-thinkingdev.pdf>.
- United Nations Development Program. 2021. *Objetivos de desarrollo sostenible*. <https://www1.undp.org/content/undp/es/home/sustainable-development-goals/background.html#:~:text=Los%20Objetivos%20de%20Desarrollo%20Sostenible,R%C3%ADo%20de%20Janeiro%20en%202012>. (Retrieved, August 23, 2021).
- Vega-Noriega, José Ángel, Carlos Eduardo Pimentel, and Francisco José Batista de Albuquerque. 2005. Sematic networks: theoretical, technical, methodologic and analytical aspects. *Ra Ximhai*, 1(3): 439-451. <https://www.redalyc.org/pdf/461/46110301.pdf>.
- Valdez, José Luis. 1998. *Las redes semánticas naturales: usos y aplicaciones en psicología social*. México: UAEM. ISBN 978-607-422-150-3.
- Veenhoven, Ruut. 2008. Sociological theories of subjective well-being. In Michael

- Eid y Randy Larsen (Eds.), *The science of subjective well-being: a tribute to Ed Diener*. New York: Guilford Publications, 44-61. ISBN 978-1-59385-581-9.
- Veenhoven, Ruut. 2012. Cross-national differences in happiness: cultural measurement bias or effect of culture? *International Journal of Wellbeing*, 2(4): 333-353. <https://doi.org/10.5502/ijw.v2.i4.4>.
- WHO. 2008. *The third ten years of the World Health Organization 1968-1977*. Switzerland: World Health Organization. <https://www.who.int/publications-detail-redirect/9789241563666>.
- Winefield, Helen, Tiffany K. Gill, Anne W. Taylor y Rhiannon Pilkington. 2012. Psychological well-being and psychological distress: is it necessary to measure both? *Psychology of Well-Being: Theory, Research and Practice. Psychology of Well-Being a Springer Open Journal*, 2: 1-14. <https://10.1186/2211-1522-2-3>.
- Zuzanek, Jiri, and Margo Hilbrecht. 2019. Enforced leisure: time use and its well-being implications. *Time and Society*, 28(2): 657-679. <https://doi.org/10.1177/0961463X16678252>.