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Electronic Supplementary Material

A Review of Quality of Life (QOL) Assessments and Indicators: Towards a "QOL-Climate" Assessment Framework

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Table S1. Research areas based on the 3251 research articles as per the WoS classification. Research areas in blue texts were the ones considered in the second stage of the bibliometric analysis, which resulted in 178 research articles.

Research Area	No. of Articles	Research Area	No. of Articles	Research Area	No. of Articles
HEALTH CARE SCIENCES SERVICES	510	ALLERGY	32	MICROBIOLOGY	4
PUBLIC ENVIRONMENTAL OCCUPATIONAL HEALTH	379	SPORT SCIENCES	31	PHYSIOLOGY	4
ONCOLOGY	368	EDUCATION EDUCATIONAL RESEARCH	29	PUBLIC ADMINISTRATION	4
SURGERY	346	SCIENCE TECHNOLOGY OTHER TOPICS	28	ZOOLOGY	4
NEUROSCIENCES NEUROLOGY	269	ENVIRONMENTAL SCIENCES ECOLOGY	24	BIOCHEMISTRY MOLECULAR BIOLOGY	3
GENERAL INTERNAL MEDICINE	201	VETERINARY SCIENCES	23	CONSTRUCTION BUILDING TECHNOLOGY	3
UROLOGY NEPHROLOGY	151	INFECTIOUS DISEASES	21	FOOD SCIENCE TECHNOLOGY	3
REHABILITATION	150	ANESTHESIOLOGY	20	GEOGRAPHY	3
PSYCHIATRY	138	NUTRITION DIETETICS	19	OPERATIONS RESEARCH MANAGEMENT SCIENCE	3
PSYCHOLOGY	135	ENGINEERING	18	PARASITOLOGY	3
DENTISTRY ORAL SURGERY MEDICINE	124	GENETICS HEREDITY	17	URBAN STUDIES	3
OTORHINOLARYNGOLOGY	124	BEHAVIORAL SCIENCES	16	WOMEN S STUDIES	3
GASTROENTEROLOGY HEPATOLOGY	123	MEDICAL INFORMATICS	16	ACOUSTICS	2
PEDIATRICS	117	INTEGRATIVE COMPLEMENTARY MEDICINE	15	CHEMISTRY	2
CARDIOVASCULAR SYSTEM CARDIOLOGY	115	SUBSTANCE ABUSE	13	DEVELOPMENTAL BIOLOGY	2
DERMATOLOGY	96	BIOTECHNOLOGY APPLIED MICROBIOLOGY	10	GOVERNMENT LAW	2
NURSING	94	CELL BIOLOGY	10	IMAGING SCIENCE PHOTOGRAPHIC TECHNOLOGY	2
RESPIRATORY SYSTEM	84	MATHEMATICS	10	INSTRUMENTS INSTRUMENTATION	2
OBSTETRICS GYNECOLOGY	83	AUDIOLOGY SPEECH LANGUAGE PATHOLOGY	8	LINGUISTICS	2
GERIATRICS GERONTOLOGY	76	ANTHROPOLOGY	7	MATHEMATICAL METHODS IN SOCIAL SCIENCES	2
RHEUMATOLOGY	75	COMPUTER SCIENCE	7	PHYSICAL GEOGRAPHY	2
SOCIAL SCIENCES OTHER TOPICS	72	REPRODUCTIVE BIOLOGY	7	REMOTE SENSING	2
ORTHOPEDICS	69	SOCIAL WORK	7	TOXICOLOGY	2
IMMUNOLOGY	66	TROPICAL MEDICINE	7	TRANSPORTATION	2
OPHTHALMOLOGY	66	BIOPHYSICS	6	AUTOMATION CONTROL SYSTEMS	1
ENDOCRINOLOGY METABOLISM	62	PATHOLOGY	6	COMMUNICATION	1
PHARMACOLOGY PHARMACY	58	EMERGENCY MEDICINE	5	CRIMINOLOGY PENOLOGY	1
RESEARCH EXPERIMENTAL MEDICINE	57	FAMILY STUDIES	5	GEOLOGY	1
BUSINESS ECONOMICS	56	LIFE SCIENCES BIOMEDICINE OTHER TOPICS	5	MECHANICS	1
HEMATOLOGY	54	SOCIAL ISSUES	5	MEDICAL ETHICS	1
RADIOLOGY NUCLEAR MEDICINE MEDICAL IMAGING	53	AGRICULTURE	4	MEDICAL LABORATORY TECHNOLOGY	1
SOCIOLOGY	52	INFORMATION SCIENCE LIBRARY SCIENCE	4	RELIGION	1
TRANSPLANTATION	50	MATHEMATICAL COMPUTATIONAL BIOLOGY	4	TELECOMMUNICATIONS	1
BIOMEDICAL SOCIAL SCIENCES	37				

Note: The total number of articles is not equal to 3251 because some articles fall in more than one research area.

Table S2. The references (articles [1-19] and indexes [20-28]) reviewed and their details. The column called "No.," which stands for number, corresponds to the column called "No." in Tables 3 and S3, and to the numbers in Figs. 4 and 5. Here, dimension also refers to domain, component or their equivalent in the context of Fig. 6.

No.	Purpose and Scope	Theoretical or Conceptual Basis	Dimension (number of indicators)	Weighting (level: dimension) – Aggregation Method (for the overall composite index)	Value Range and Unit (for the overall composite index)	Reference [a]
1	This study describes an index methodology for measuring quality of life in different periods of time. The methodology has been applied in 314 municipalities of the province of Barcelona, Spain. Context or Sector: General	Based on the concept of multidimensionality, which is the basis for the general concept of well-being	Individual opportunities for progress (5); Index of social equilibrium (6); Community conditions of life (7)	Using equal weights - Weighted additive aggregation	From less than 100 (low) to greater than 100 (high) (see reference for range)	Royuela et al. (2003)
2	This study demonstrates how a specific problem in urban quality of life evaluation can be addressed by a geo-visual multi-criteria evaluation, using Toronto, Canada as a case study. Context or Sector: Urban/City	Based on the concept of "urban quality of life" as either referring to personal health and well-being or to the residential environment	*Classical quality of life:* Benefits criteria (5); Cost criteria (5). *Contemporary quality of life:* Benefits criteria (7); Cost criteria (1)	Analytic Hierarchy Process - Weighted additive aggregation	Census tracts are ranked	Rinner (2007)
3	This study integrates remote sensing and census data to measure quality of life in the city of Indianapolis. Context or Sector: Urban/City	Based on the concept of "urban quality of life" as a function of environmental and socioeconomic variables	*Environmental variables:* Greenness; Impervious surface; Temperature. *Socioeconomic variables:* Population density; Income; Poverty; Employment rate; Education level; House characteristics	Factor analysis - Weighted additive aggregation	From less than negative one (low) to greater than two (high) (see reference for range)	Li and Weng (2007)
4	This study develops an integrated method to evaluate accessibility, quality of life, and social interaction, using Takamatsu, Japan as a case study. Context or Sector: Urban/City (Transportation-related)	Based on the concept of "quality of life" focusing on the livability of the environment (physical and social)	Safety and security (4); Economic opportunity (3); Service and cultural opportunity (3); Spatial amenity (3); Environmental benignity (3)	Survey questionnaire - Weighted additive aggregation	0-100 (low-high)	Doi et al. (2008)

5	This study presents a multidimensional analysis of welfare based on the social indicators approach aimed at assessing the quality of life in the 25 member countries of the European Union. Context or Sector: General	Based on the concept of quality of life as a function of social indicators	A total of 27 indicators in various contexts (dimensions) were used to derive a single quality of life index. The World Database of Happiness was used to assess subjective well-being.	Factor analysis - Factor analysis	-2.5 to + 2.5 (low-high)	Grasso and Canova (2008)
6	This study focuses on the construction of an education index in Human Development Index (HDI) from global, national, and 18 sub-national human development reports in India since 1990. Implications were highlighted for measurement of quality of life indices with special reference to physical quality of life index. Context or Sector: General	The assessment of quality of life was based on the concept of physical quality of life as a function of three indicators	It cited a previous study that used three indicators to derive the physical quality of life index: infant mortality; life expectancy at age one; education (measured by basic or adult literacy rate).	Using equal weights - Weighted additive aggregation	0-100 (low-high)	Narayana (2009)
7	This study assesses quality of life in Uttarakhand, India using geospatial techniques. It attempted to estimate environmental variables from remote sensing imagery, and to design and develop a census database to extract socio-economic variables. Context or Sector: General	Based on the concept of "quality of life" as a function of objective socioeconomic and environmental variables	*Environmental variables:* Green vegetation; Impervious surface; Temperature. *Socioeconomic variables:* Population density; Housing density; Median household income; Per capita income	Factor analysis - Weighted additive aggregation	Qualitative scale (low-high)	Rao et al. (2012)
8	This study presents the application of quality of life techniques to the transport networks of Glasgow and Manchester to determine if this is a valuable alternative in transport appraisal. Context or Sector: Urban/City (Transportation-related)	Based on the concept of "transport quality of life" as a tool to appraise the economic, environmental, and social impacts of transport projects	Final: Access and availability (3); Environment (3); Sustainable transport (2); Personal safety (2); Travel costs (2)	Dimensions were unaggregated	Not applicable	Carse (2011)
9	This study explores the possibilities presented by DEA to assess quality of life and evaluate the performance of city managers with regards to concerns in promoting urban quality of life in European cities. Context or Sector: Urban/City	Based on the concept of "urban quality of life"	Demography (3); Social aspects (7); Economic aspects (5); Civic involvement (1); Training and education (3); Environment (4); Transport and travel (2); Information society (1); Culture and recreation (3)	Data envelopment analysis (DEA) - DEA's weighted additive aggregation	0-100% (low-high)	Morais and Camanho (2011)

10	This study quantifies the relative importance of three different geographic levels of analysis in assessing the quality of life of the Spanish population. Context or Sector: General	Based on the concept of quality of life as social welfare	The study used 19 variables, composed of 8 “drawbacks” (negative) and 11 “advantages” (positive)	Value efficiency analysis (VEA) - VEA's weighted additive aggregation	0-100 (low-high)	González et al. (2011a)
11	This study measures quality of life for the largest 237 Spanish municipalities using Value Efficiency Analysis (VEA) to derive comparative scores by combining the information contained in 19 partial indicators. Context or Sector: General	Based on the concept of quality of life as social welfare	The study used 19 variables, composed of 8 “drawbacks” (negative) and 11 “advantages” (positive)	Value efficiency analysis (VEA) - VEA's weighted additive aggregation	0-1 (low-high)	González (2011b)
12	This study proposes an innovative methodology to measure urban quality of life when equity concerns arise. The method was applied to derive a quality of life index for the city of Milan. Context or Sector: Urban/City	Based on the concept of “urban quality of life” as the monetary value of urban amenities	The study used six amenity variables to derive an overall quality of life index	Using implicit prices - Weighted additive aggregation	Amount of money per neighborhood	Brambilla et al. (2013)
13	This study presents a comprehensive evaluation of the objective quality of life in the 31 provincial administrative divisions in Mainland China from 2006 to 2009 using principal component analysis (PCA). Context or Sector: General	Based on the concept of objective quality of life as measured from seven aspects	Economy (4); Consumption (3); Health (6); Science and education (4); Social security (5); Environment (5); Cultural and leisure activities (2)	Weights based on variance - Principal component analysis	From 0.0733 (low) to 2.3659 (high) (see reference for range)	Li and Wang (2013)
14	This study discusses two basic theories of social measurement in development studies: The quality of life (QOL) and social quality (SQ) theories. Based on survey data collected from six Asian societies, several QOL and SQ factors were examined to illustrate how these two approaches are both distinctive and complementary. Context or Sector: General	Based on the concepts of quality of life and social quality as two basic theories of social measurement in development studies	Income situation and satisfaction (4); Work situation and satisfaction (4); Health care situation and satisfaction (3); Education situation and satisfaction (3); Environment situation and satisfaction (2); Social relations situation and satisfaction (3)	Unweighted – Averaging	Not applicable	Lin (2013)
15	This study assesses the urban quality of life in European cities from the perspective of qualified human resources. Urban quality of life was measured through a composite indicator constructed using data envelopment analysis.	Based on the concepts of human capital and quality of life as an overall level of well-being and fulfillment	Political and social environment (7); Economic environment (1); Medical and health issues (14); Schools and education (6); Public services	Survey results by Mercer - DEA's weighted additive aggregation	0-100% (low-high)	Morais et al. (2013)

	Context or Sector: Urban/City		and transport (5); Recreation (5); Housing (7); Natural environment (5)			
16	This study measures the quality of life of people living in the Indian city of Delhi using the fuzzy sets theory, an approach that is designed to handle inexact or "fuzzy" outcomes. Context or Sector: Urban/City	Based on quality of life viewed as a fundamental aspect of development and advancement of human societies and the fuzzy sets theory	Overall maintenance services (2); Green spaces in the neighborhood (4); Safety (3); Market facilities (3); Shelter (5); Transport services (5); Essential services (2)	Frequency-based weighting structure - Borda Rule (ordinal aggregator)	Qualitative scale (worst-best)	Kapuria (2014)
17	This study identifies and measures the quality of life dimensions in urban transitional neighborhoods using both objective and subjective indices pertaining to Tehran's Darvazeshemiran neighborhood. Context or Sector: Urban/City	Based on the concept of quality of life considered as an approach to assess the levels of general welfare of the communities	For Objective QOL: Availability of basic facilities (4); Socio-economic properties (5); Availability of recreational and sport facilities (5); Housing status (4); Housing congestion (2) For Subjective QOL, refer to the article.	For Objective QOL: Weights based on variance - Principal component analysis (Weighted additive aggregation) For Subjective QOL, refer to the article.	1-6 (low-high)	Soleimani et al. (2014)
18	An expert system for quality of life evaluation is developed as a new information technology derived from artificial intelligent research. This study presents a completely novel and innovative approach to quality of life evaluation—the usage of expert systems. Context or Sector: General	Based on the concepts of expert system, sustainability, and quality of life as a shared and balanced process	The expert system includes eight domains to determine the degree of quality of life: (1) Economic situation; (2) Housing and environment; (3) Employment, education and skills; (4) Household and family relationships; (5) Balance between work and life; (6) Health and healthcare; (7) Urban subjective; and (8) Concepts of the quality of the society	Uncertainty factor - Expert system	Qualitative scale (No quality of life – Perfect quality of life)	Atanasova and Karashtranova (2016)
19	This study assesses tourism-related community quality of life, incorporating resident perceptions of satisfaction, importance, and tourism effects in Orange County, located in South Central Indiana. Context or Sector: Tourism	Based on the concepts of tourism-related community quality of life and sustainable tourism development	Community conditions (17); Community services (12)	Dimensions were unaggregated	Not applicable	Yu et al. (2016)

20	*Human Development Index (HDI).* HDI is a composite index of life expectancy, education, and per capita income indicators. It can be viewed as an index of "potential" human development or the maximum IHDI (see below) that could be achieved if there were no inequalities. Context or Sector: General	Based on the concept of "human development" – the progress towards greater human well-being	Long and healthy life (1); Knowledge (2); A decent standard of living (1)	Unweighted – Geometric mean	0-1 (low-high)	UNDP (1990, 2010, 2013)
21	*Genuine Progress Indicator (GPI).* GPI is a metric developed to supplement the gross domestic product (GDP) indicator. It takes a fuller account of well-being by incorporating other variables not considered in the GDP such as environmental and social factors. Context or Sector: General	Based on the concept of "sustainability," including the concepts of "costs" and "benefits"	Utility from consumption of market-based goods and services (5); Utility derived from the services of essential capital (4); Disutility associated with undesirable conditions and trends and externalities (4)	Unweighted – GPI equation	Amount of money per capita	Cobb et al. (1995); Talberth and Weisdorf (2017)
22	*Happy Planet Index (HPI).* HPI is designed to challenge well-established indices of countries' development regarded as not taking sustainability into account, such as the GDP and HDI. It does not measure which are the happiest countries in the world, but rather measures the environmental efficiency in supporting well-being in a given country. Context or Sector: General	Based on the concept of "sustainability," including the concept of "ecological footprint"	Life expectancy (1); Experienced well-being (1); Inequality outcomes (4); Ecological footprint (1)	Unweighted – HPI equation	0-100 (unitless)	Marks (2006); NEF (2016)
23	*Cities of Opportunity (Quality of Life) (COQOL).* COQOL assesses the urbanites' quality of life through four indicators: transportation and infrastructure; health, safety, and security; sustainability and the natural environment; and demographics and livability. It focuses on the infrastructure that serves the public good. Context or Sector: Urban/City	Based on the concept of "sustainability," including the concept of "global cities"	Transportation and Infrastructure (7); Health, safety and security (6); Sustainability and the natural environment (7) Demographics and livability (7)	Dimensions were unaggregated	Not applicable	PwC (2016) [b]

24	*Inequality-adjusted HDI (IHDI).* IHDI is a measure of the level of human development of people in a society that accounts for inequality. When there is inequality in the distribution of health, education, and income, the HDI of an average person in a society is less than the aggregate HDI. The lower the IHDI (and the greater the difference between it and the HDI), the greater the inequality. Context or Sector: General	Based on the concepts of "inequality" and "human development" – the progress towards greater human well-being	Long and healthy life (1); Knowledge (2); A decent standard of living (1). These dimensions are all inequality-adjusted	Unweighted – Geometric mean	0-1 (unitless)	UNDP (2010, 2013)
25	*Better Life Index (BLI).* BLI sought to address concerns that standard macroeconomic statistics like GDP failed to give a true account of people's current and future well-being. Its online interactive tool allows users to compare well-being across countries in the areas of material living conditions and quality of life based on 11 topics the OECD has identified as essential. Context or Sector: General	Based on the concept of "a good or a better life" and "inequality"	Housing (3); Income (2); Jobs (4); Community (1); Education (3); Environment (2); Civic engagement (2); Health (2); Life satisfaction (1); Safety (2); Work-life balance (2)	User-defined weights (web version) – Dimensions were unaggregated	No final index, but its web application allows users to assign weights to the dimensions	OECD (2011, 2017)
26	*Human Sustainable Development Index (HSDI).* The HSDI is a proposed index of sustainable development in which an environmental component is added to the existing three socioeconomic indicators of the HDI. It proposes to include each nation's per capita carbon emissions as a proxy indicator of the environmental component of the triple bottom line of sustainability. Context or Sector: General	Based on the concept of "sustainable development"	Long and healthy life (1); Knowledge (2); A decent standard of living (1); Per capita carbon emissions (1)	Unweighted – Geometric mean	0-1 (unitless)	Togtokh (2011)
27	*Social Progress Index (SPI).* SPI is an aggregate index of social and environmental indicators that capture three dimensions of social progress: basic human needs, foundations of well-being, and opportunity. It defines social progress as the capacity of a society to meet the basic needs of its citizens, establish the building blocks that allow citizens and communities to enhance and sustain the quality of their lives, and create the conditions	Based on the concepts of "social progress," "well-being," and "sustainability"	*Basic Human Needs:* Nutrition and basic medical care (5); Water and sanitation (3); Shelter (4); Personal safety (5). *Foundations of Living:* Access to basic knowledge (4); Access to information and communication (3); Health and wellness (3); Environmental	Using equal weights – Averaging	0-100 (unitless)	Porter et al. (2014) [c]; Stern et al. (2017)

	for all individuals to reach their full potential. Context or Sector: General		quality (4). *Opportunity:* Personal rights (4); Personal freedom and choice (5); Tolerance and inclusion (5); Access to advanced education (5)			
28	*Social-Ecological Status Index (SESI).* SESI is designed to measure social-ecological status based on social-ecological resilience and pressure. It is derived by using a framework that integrates various environmental and socioeconomic indicators, including indicators under the triple bottom line of sustainability. Context or Sector: General	Based on the concepts of "sustainability," "resilience," "pressure," and the social-ecological system paradigm.	*Source of social-ecological resilience:* Social integrity (1); Governance integrity (1); Ecological integrity (2). *Sources of social-ecological pressure:* Exposure to hazard (1); Sensitivity to hazard (2); Environmental pressure (2)	Using equal weights – SESI equation	-1 to +1 (unitless)	Estoque and Murayama (2014, 2017)

[a] The year reflects the date of first release or publication. [b] The first study was in 2007. [c] 2013 Beta version is available.

Table S3. Details on how subjective well-being (satisfaction, happiness, fulfillment, welfare, etc.) was explicitly considered in the respective assessments of some of the references. The column called "No.," which stands for number, corresponds to the column called "No." in Tables 3 and S2, and to the numbers in Figs. 4 and 5.

No.	Detail	Reference
4	Indicators were rated by the respondents based on their perceptions and satisfactions.	Doi et al. (2008)
5	Subjective well-being was based on the attitudes to life (life satisfaction) of respondents, taken from the World Database of Happiness.	Grasso and Canova (2008)
8	For each indicator, the respondents were asked to rate their quality of life with regards to transport.	Carse (2011)
14	Indicators were rated by the respondents based on their perceptions and satisfactions.	Lin (2013)
16	Indicators were rated by the respondents based on their perceptions and satisfactions.	Kapuria (2014)
17	Domains and indicators were rated by the respondents based on their satisfactions.	Soleimani et al. (2014)
18	In the "expert system" approach, the dimensions of quality of life 'are' assessed by the users based on their perceptions and satisfactions.	Atanasova and Karashtranova (2016)
19	Indicators were rated by the respondents based on their perceptions and satisfactions.	Yu et al. (2016)
22	This index used respondents' ratings of their own well-being.	NEF (2016)
23	With the use indicators like "quality of living" and "senior wellbeing". See reference.	PwC (2016)
25	This index used respondents' ratings of their own life satisfaction.	OECD (2017)

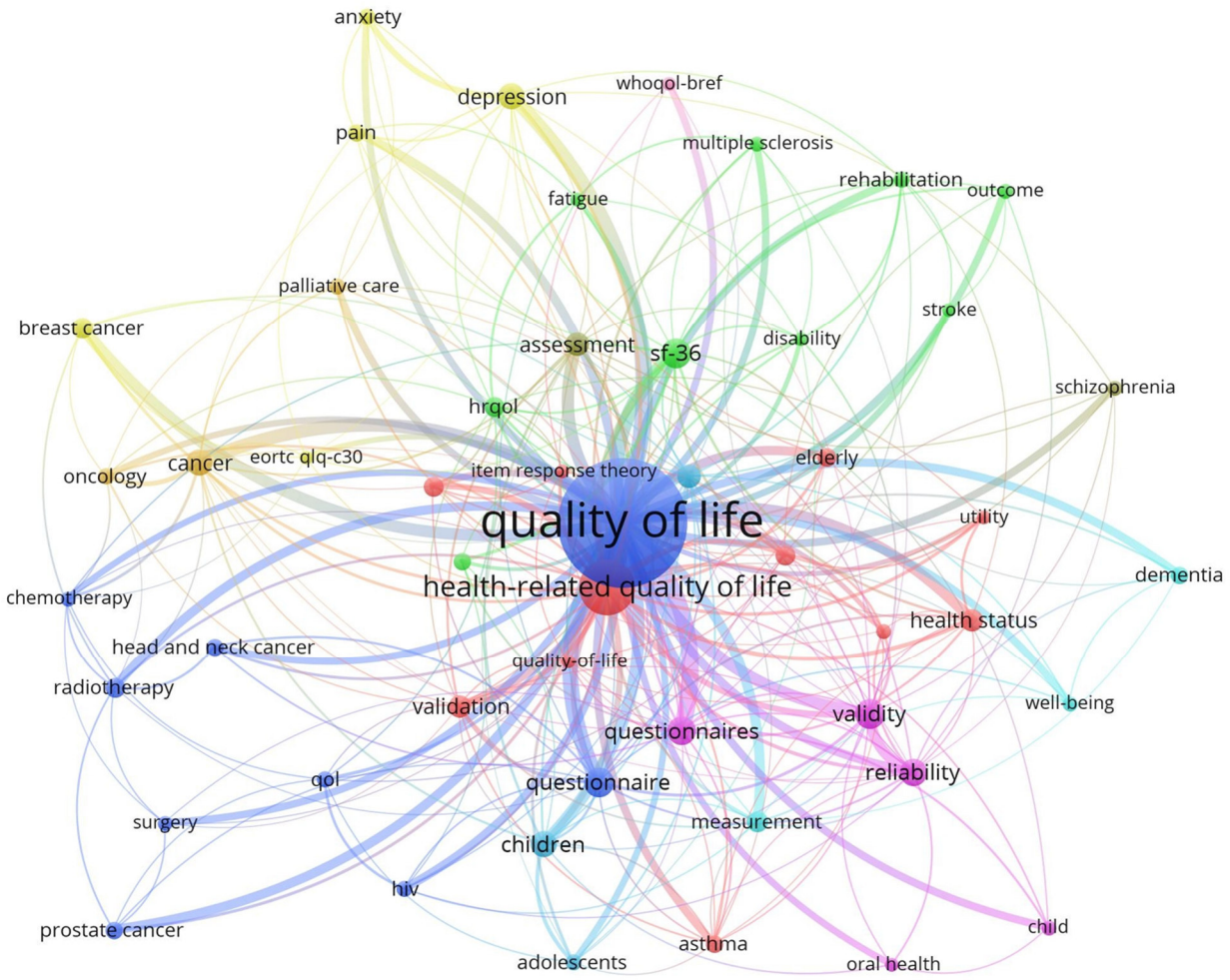

Fig. S1. Total occurrences and network of authors' keywords based on the 3251 articles. Note: Fractional counting was used, which means that the weight of a link was fractionalized. For example, if a keyword co-occurs with five other keywords, each of the five keywords has a weight of 0.2 (1/5). For these 3251 articles, a threshold of 20 was used (i.e. the minimum number of occurrences for each keyword), which resulted in a total of 51 keywords.

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