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From Health Technology Assessment to Health Technology Sustainability

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Received: 30 October 2018; Accepted: 11 December 2018; Published: 12 December 2018

Abstract: This paper aims to propose a methodological lens to the assessment of technological innovations in healthcare based on the principles of social, economic, and political sustainability. Starting from the consideration of a lack of a unified interpretative framework of health technology assessment, using a content analysis of the relevant literature on the topic, we identified both the scientific perspectives adopted by the scholars and the most widely discussed topics. Consequently, the less explored scientific areas were framed, and, therefore, those more susceptible to further investigation came to light. The result is an overall picture which highlights the absence of unified and generally accepted approaches to evaluation, together with the lack of awareness on the fact that the multiplicity of methods adopted is essentially connected to the multiplicity of innovations, for each of which a method (or a set of methods) of preferable evaluation can be prefigured. Based on these observations, we propose a general reference framework for evaluation, based on the Viable Systems Approach (vSa), and a schematic outline of the connections between the complexity of innovations and the evaluation methodologies.

Keywords: health technology assessment; evaluation methods; viable systems approach; healthcare; sustainability

1. Introduction

The increasing attention to the treatment and care of patients makes central the role of healthcare technologies, as they are in constant development [1]. Indeed, technology has the potential to enhance efficiency and effectiveness in multiple areas of healthcare, and represents a great opportunity to improve the patient care and to increase the efficiency and effectiveness of all healthcare stakeholders, including policy makers, regulatory authorities, payers, and physicians [2]. Remote sensors, robotics, genomics, stem cells, and the availability of big data are just some of the innovations in this sector [3]. Only considering artificial intelligence, there are already numerous examples of how it can enhance the medical profession. Robot-assisted surgery, virtual nursing assistants, and technologies are able to identify changes in the usual behavior of patients; it also opens a wide debate on ethical and social challenges [4]. However, technology alone cannot improve the whole healthcare system, and a successful implementation requires a complete understanding "a priori" of the technology capabilities and its application [5]. Moreover, the economic and health policy issues increasingly influence healthcare technology solutions, with the aim to keep the healthcare quality high and the costs under control, especially regarding the pharmaceutical sector [3].

Considering the complexity of the healthcare context, the Health Technology Assessment (HTA) has been developed as a set of techniques able to support decisions regarding health policy, pushed by two driving forces: one relates to the more and more serious budget constraints due to the recession; the

other relates to the increasingly demanding policy makers and funders, who require greater evidence for new and existing therapies [6].

Adopted primarily in the USA in the 1970s [7,8] and rapidly spread in Europe in the following decades, HTAs are currently being introduced in most countries of the world [3]. During the 1970s, the focus was to summarize the evidence concerning studies on the cost effectiveness of health interventions. Afterwards, at the end of the 1990s, HTA widened its focus from the evaluation of only large, expensive and machine-based technologies also to smaller technologies and healthcare, addressing broader issues (organizational, social implications, and ethics) [7]. Currently, the health technology assessment processes critically evaluate reimbursement submissions of pharmaceuticals, simple medical devices, and complex medical devices, such as hospital technologies [9], vaccines, procedures, health services, and public health interventions. Therefore, they are becoming an important tool to support health policy decisions in many countries [9].

Nowadays, the importance of HTAs has increased further, also spreading in Central and Eastern European countries. HTA activities have a national focus associated with the Ministry of Health and, by influencing health policy documents of the European Commission, it seems likely that, in the future, the HTA will be institutionalized somehow as part of the EU's activities. The task of applying HTA techniques for the evaluation of new health technologies is devolved to the different government support bodies (e.g., NICE in the UK, IQWIG in Germany, and AGENAS in Italy).

Thus, HTAs act to define a policy research approach that examines the short and long-term social, economic, and political consequences of the application or use of technology [10], evaluating in a multidisciplinary way, medical technology about efficacy, safety, feasibility, cost, cost-effectiveness, and indications for use [11].

Although many attempts have been carried out, a unified approach has not yet been defined, and the institutions may fail to optimize their future technology acquisition, thus purely considering the medical innovation as an increasing financial risk [12,13]. Furthermore, several biomedical technologies approved are adopted based on limited evidence of safety and effectiveness [3,5,14]. Indeed, these innovative therapies, as digital innovations and revolutionary technologies (such as 3D bioprinting), present not only opportunities but also a complex set of technical, ethical, and financial challenges. Healthcare consumers are also inclined to be more sensitive to medical treatments costs, whether they value more or less the information in reducing future health uncertainty [15]. In any case, considering the real potential of the new technologies to improve the healthcare system, a new approach is required, able to support decision-makers to modernize the pre-existing framework and to exploit new technologies in a more efficient, effective and sustainable way [2] while also protecting patients, spending resources more wisely, and fostering the "right" type of innovation in the future [3].

Currently, cost effectiveness analysis is the most frequently used methodology [16] but, as far as it supports the allocation of resources [4], it suffers from theoretical limitations that make it inappropriate in many situations, leading to contraindications [17,18].

In particular, technological innovation, as regards cost-containment measures, is an important factor for managing high and increasing health costs. In literature, the evidence suggests that enhanced health technologies generally increase rather than reduce healthcare expenditures. Indeed, nations with a greater degree of integration into the health system have relied on spending controls and global budgets to control costs [15,19].

In this direction, this paper reviews the different contributions existing in literature regarding the methodologies connected to the HTA, highlighting the alternative approaches proposed [20,21] and identifying the main weaknesses.

A lack of unified generally accepted analysis schemes still exists. The methodologies currently used are consequently unsatisfactory: the literature that criticizes the cost-effectiveness analysis (CEA) is wide, currently being the most widespread evaluation methodology. Similarly, the literature that proposes alternative approaches to evaluation is wide as well.

Starting from this, we noted the lack of a holistic vision in HTA techniques able to understand—even if not able to quantify, as in the ambition of the cost-benefit analysis—the multiplicity of subjects and effects of innovation in healthcare. In this regard, we propose a rereading of the existing evaluation methods, through the interpretative lens of the Viable Systems Approach (vSa) [22–24], with the aim to consider, in this complex scenario, the multiplicity of entities and effects that over time are influenced by new technologies. A systems approach to decision-making is suggested, able to consider economic, social, and political aspects together with relations and interactions between them [25].

Few contributions address the topic of healthcare in a systems perspective and together with the topic of evaluations: in this sense, vSa becomes a bridging concept by the means of which the sustainability perspective can be incorporated into the management control system of healthcare organizations [26].

Based on previous considerations, the paper is structured as follows: Section 2 introduces the methodology adopted herein for a content analysis of the literature contributions on HTA. Thereafter, the viable systems approach is presented, as a theoretical framework for the analysis of health technology assessment, in the light of sustainability issues. Finally, a re-reading of healthcare assessment methods is proposed. The paper concludes with a discussion and conclusions.

2. Materials and Methods

In order to carry out a content analysis of the relevant literature on the topic, we used the textual contents of the scientific contributions on the analysed subject/topic, derived from the set of keywords, consisting of the author keywords plus those provided by Scopus through the encoding of the abstracts and the titles of the bibliographic references, contained in each recorded contribution. We used the method of co-occurrence of the keywords as a basis for the analysis, with the aim of identifying the scientific perspectives adopted by the scholars and the most widely discussed topics and, consequently, discerning the less explored scientific areas and those more susceptible to further investigation. The method adopted herein was the content analysis [27,28], modified due to the availability of textual data already codified by third parties. This change appears to provide a number of advantages: it abstracts from the subjectivity of those who carry out the codification; it guarantees the repeatability of the analysis, as the text bases are publicly available; it calls for the progressive formulation of hypotheses according to the discovery principles of grounded theories [29,30].

Data Collection and Methodology

The multidisciplinary nature of the topic made it necessary to limit the research to the contributions that are most consistent with the objectives of our work (the "Health Technology Assessment" query on Scopus returns 4511 results without limitations, 2/3 of which in the medicine area).

Therefore, data were collected through a research on Scopus using the query TITLE-ABS-KEY ("health technology assessment") AND (LIMIT-TO (SUBJAREA, "ECON") OR LIMIT-TO (SUBJAREA, "SOCI") OR LIMIT-TO (SUBJAREA, "BUSI") OR LIMIT-TO (SUBJAREA, "DECI")) AND LIMIT-TO (DOCTYPE, "ar")).

The results were 212 contributions, in the subject areas of *Economics*, *Econometrics and Finance*, *Social Sciences*, *Business*, *Management and Accounting* and *Decision Sciences*. We exported the results, choosing to consider all of the available information, except the index keywords (as to only analyse the author keywords), in CSV (Excel) format.

The data collection method, being based on the Scopus database, is subject to the shortcomings of the database itself, most notably the presence of duplications. For example, one study found 12% of the records in the seven Scopus-indexed journals to be duplicate [31]. As to solve the problem of data duplication, Vuong et al. [32] introduced an open database of the scientific output of Vietnamese researchers, using scientist's self-reports, open online sources, and cross-checking with Scopus database. Given the size of the sample in our study, it was possible to verify the presence of duplications directly in the exported CSV file from Scopus and edit it accordingly.

The adapted version of the content analysis required the use of the VosViewer software [33,34], developed with the specific purpose of constructing, displaying and making publicly available bibliometric maps. VosViewer software provides distance-based bibliometric maps, e.g., graphical representations, in which the importance of a term is represented by its size, and the distance between two terms reflects the strength of the relationships between them: the smaller the distance, the more intense the relationship that binds them.

For the type of the analysis, we used the co-occurrence model of the author keywords in fractional counting. Aiming to regroup the same keywords expressed in different ways (e.g., Health Technology Assessment, HTA) and delete the keywords not strictly relevant to the purposes of this article (for example those that indicate the specific geopolitical areas or specific pathologies) we created a thesaurus, as presented in Table A1. The resulting keywords were 1724, 160 of which repeated at least five times, allowing us to obtain the map represented in the "density visualization" mode (Figure 1) and in the "network visualization" mode (Figure 2) (keywords extracted: 104). The map has been made publicly available, as seen in the Supplementary Materials section.

We made available, in Table A2, all of the 212 contributions considered in the content analysis, displaying the weight of each contribution with regards to total link strength and citations, as to show the closeness of data points.

Table 1 shows the strength of the links of the main keywords with the keyword "Health Technology Assessment".

Table 1. Keywords' link strength in relation to "Health Technology Assessment".

Keywords	Link Strength
Decision-making	7.97
Health Care Policy	5.68
Cost Effectiveness Analysis	4.82
Evidence	4.28
Ethics	4.22
Medical Technologies	3.99
Health Care Systems	3.81
Cost Benefit Analysis	3.74
Economic Evaluation	3.63
Reimbursement	3.55
Procedures	3.44
Innovation	3.1
Economics	2.84
Health Economics	2.47
Pharmaeconomics	2.14
Health Care Costs	2.11
Public Health	2.02
Drug costs	1.91
Medical Decision-making	1.77
Standards	1.75

Data in Table 1 essentially show two scientific areas: that of decision-making to support health policy for the design of effective and efficient Health Care Systems, in which ethical issues are very important, and that of evaluation techniques and implementation of results with methodological insights and adaptations to local situations (Cost Benefit Analysis, Economic Evaluation, Reimbursement).

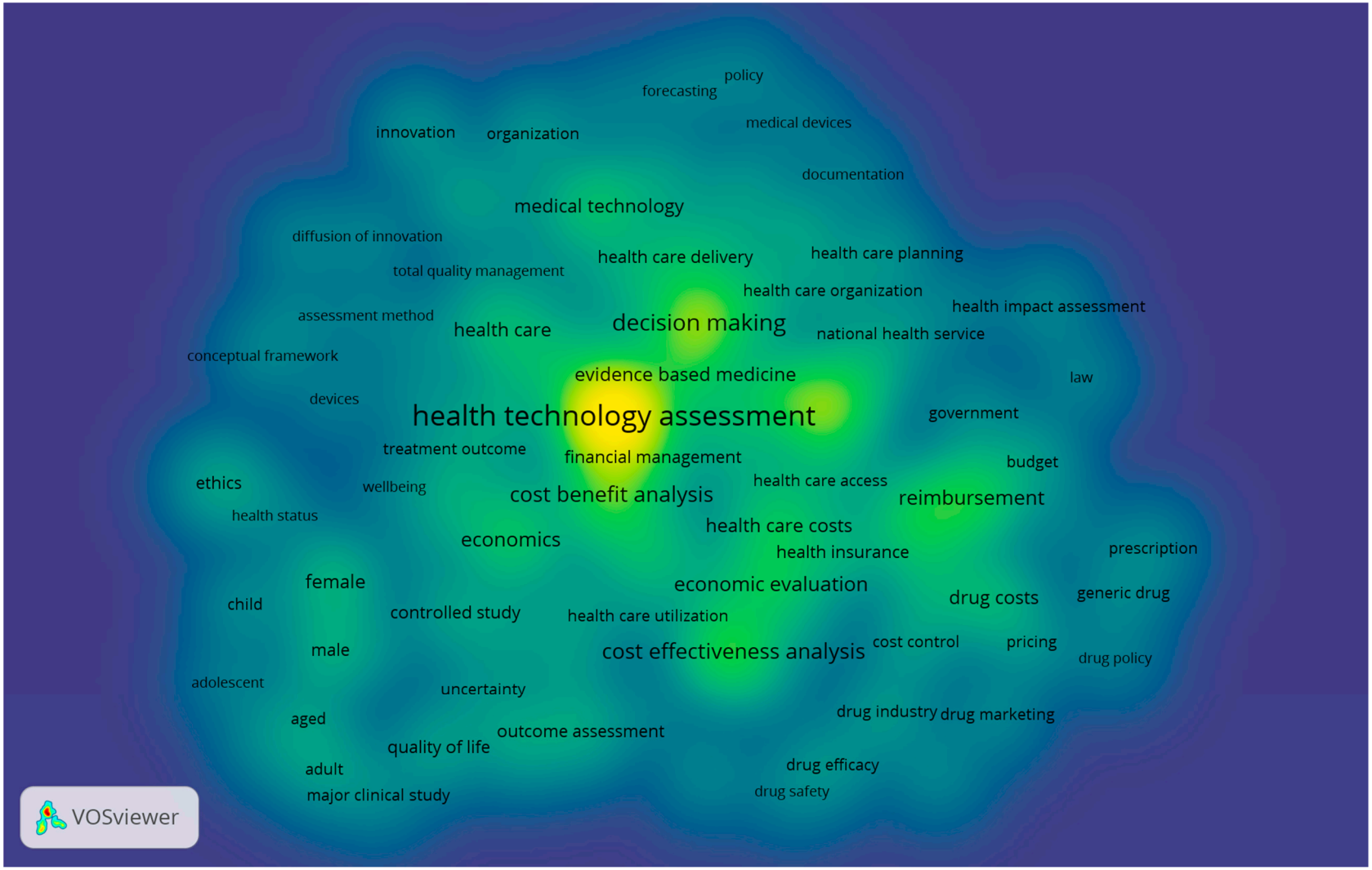

Figure 1. Density visualization.

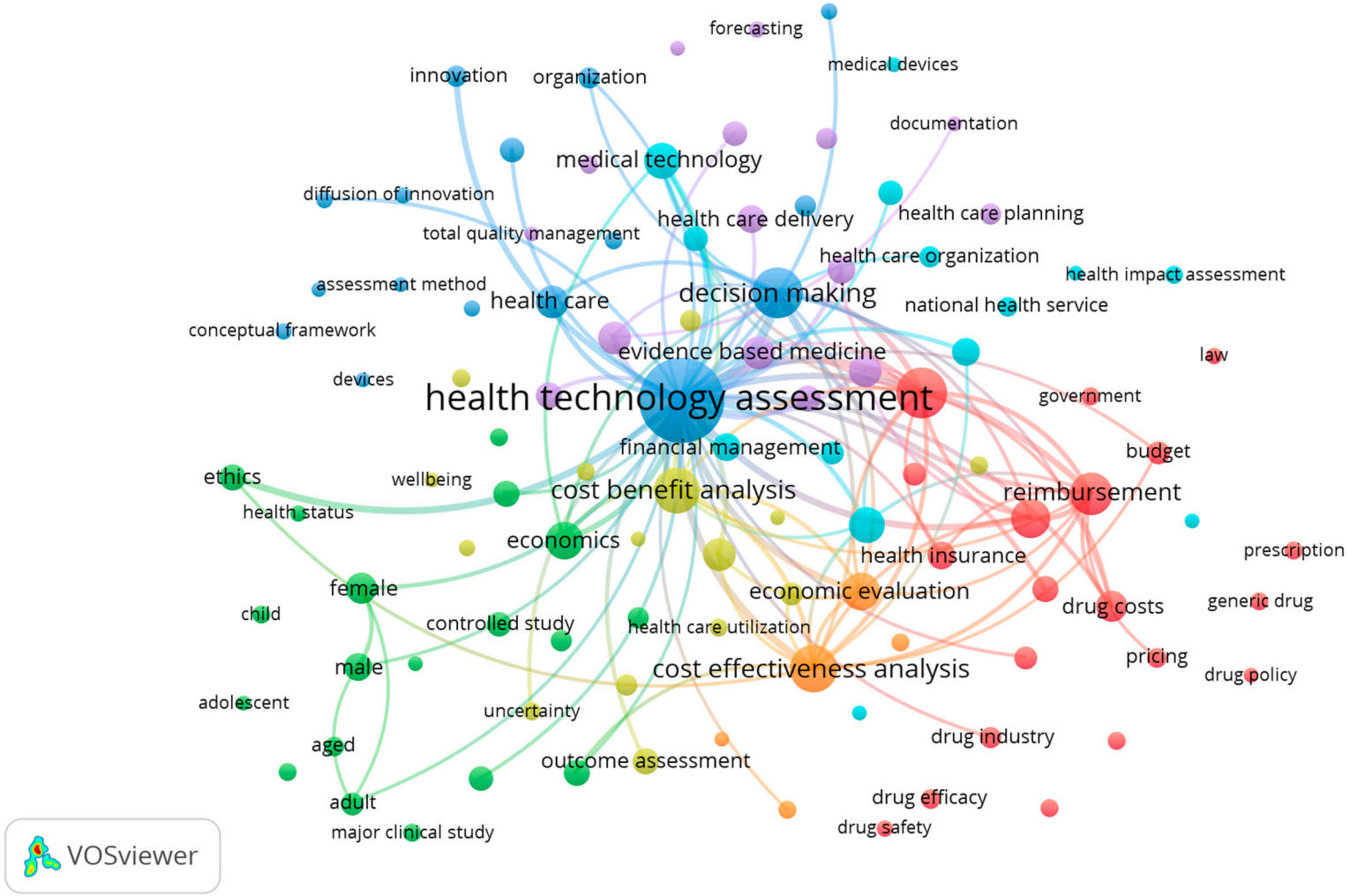

Figure 2. Network Visualization.

3. Results

The analysis carried out highlights two fundamental aspects of the problem:

- the lack of a holistic approach which, starting from evaluation methodologies able to embrace the complex of direct and indirect effects of the introduction of an innovation in healthcare on all the actors involved, constitutes a general and commonly accepted framework of reference; and
- the lack of awareness that the multiplicity of the methods adopted derives from the multiplicity of the characteristics of the innovations, for each of which specific methods are preferable.

Regarding the first aspect, the principles of the vSa described below are certainly helpful. Regarding extremely differentiated fields of investigation, far from the ambition of realizing a taxonomy of the innovations in healthcare to each class of which linking a particular evaluation technique, the considerations of Section 3.2 below are, however, possible.

3.1. The vSa as a Framework for the Analysis of Unified Health Assessment

As emerges from the above, the fundamental Health Technology Assessment seems to be focused mainly on cost-effectiveness considerations rather than on the assessment of the benefits of technology. Considering also the lack of an interpretative framework of HTA based on the principles of social, economic, and political sustainability [25], we aim to propose a methodological lens to the analysis of unified healthcare assessment that overcomes a reductionist approach to the study of this phenomenon and its related issues. Specifically, we believe an inclusive and holistic conceptual framework is needed, able to consider the variety of dimensions, which are the subjects and the effects that, over time, are influenced by the introduction of a new technology or a new drug in healthcare context.

In this sense, as shown in Figure 3, we need to shift the focus from efficiency and effectiveness concepts to that of sustainability in the Healthcare Technology Assessment, incorporating the politico-institutional suprasystems, until now neglected [25].

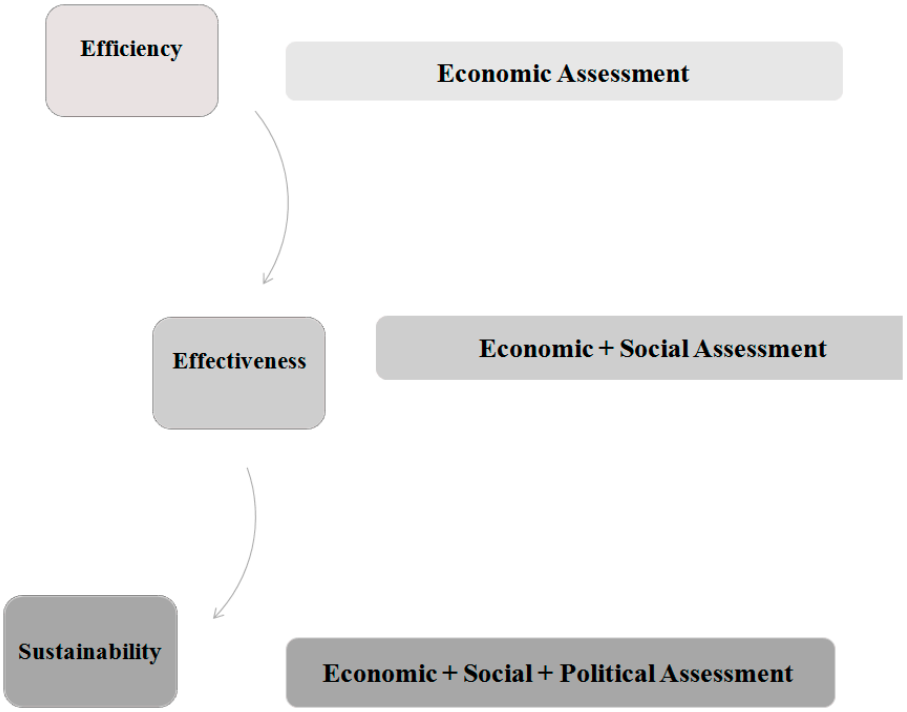

Figure 3. The shift in perspective in health technology assessment.

Accordingly, we propose a systems view, able to highlight key elements of analysis to any system's functioning in a social as well as economic context [35,36].

Among systems view, the one adopted herein is the one of Viable Systems Approach (vSa) [22–24,37]. It is a meta-level lens, with respect to the specific observed phenomena, that provides general useful interpretation schemes.

The Viable Systems Approach, starting from Stafford Beer's Viable System Model [38], proposes several conceptual innovations, which can be summarized in the following principles [39]:

- Survival: a viable system has the aim to survive in a specific context;
- Eidos: from an ontological viewpoint, a viable system can be considered in both a structural and a systemic perspective;
- Isotropy: in terms of behavior, a viable system distinguishes an area of decision-making and one of acting;
- Acting: its aim is to reach a result, an objective, through the interaction with supra and subsystems from which the system receives, but to which it also supplies, indications and rules; and
- Exhaustiveness: external entities are also viable systems, which are components deriving from a superior level.

From the principles explained above, it emerges that, in the vSa perspective, every entity capable of action (viable system) can be observed both in its structural configuration (static perspective) and in its becoming (dynamic perspective). The static perspective pertains to the structure and describes a viable system "as it is", allowing the identification of a physical boundary between what it is internal and external to the structure. Conversely, the dynamic perspective regards the system, understood as a "specific structure oriented to the achievement of a purpose", namely survival [39]. The structure-system dualism generates a conceptual dichotomy between relation and interaction. The relation has a "structural", static and objective nature, and it is configured as a physical or logical connection between the components of the structure. The interaction, instead, presupposes a relation and it is a dynamic and "systemic" concept that takes on different connotations, according to the perspective of the observer.

Furthermore, from a systems view, environment and context are two different concepts. The context is the result of a process of perception and subjective interpretation of the environment by the decision-maker of a viable system. The decision-maker filters only the entities considered relevant from the environment, thus identifying other viable systems with which to relate, the so-called supra-systems. They are systems capable of projecting their expectations on another system, which is qualified as a subsystem. The relevance depends on the ability of each suprasystem to condition the chances of survival of the considered viable system. It is also possible to measure the degree of relevance by referring to the resources released by the suprasystems, according to their ability of affecting the considered system's survival. In this sense, within the context of reference different actors mature different expectations with respect to the same viable system.

These expectations translate into the ability of the viable system itself to ensure targets of efficiency, effectiveness, and sustainability.

These three dimensions can be defined as follows [2,40]:

- Efficiency (plans): things are done in the right way.
- Effectiveness (goals): the right things get done.
- Sustainability (relationships): The right relationships exist with other service systems.

Bringing back these definitions to the vSa perspective, the objectives of efficiency can be measured with reference to the structure, while the effectiveness of the viable system is realized and measured with regard to its specific context of reference. Thus, it is possible to achieve sustainability objectives in relation to the general environment. From the above it derives that pursuing sustainability objectives is fundamental and functional to guaranteeing the conditions of viability and, therefore, the survival of the system [41,42].

In fact, in this case, we mean sustainability as a simultaneous achievement of economic, social and environmental sustainability, paying specific attention to the politico-institutional suprasystems, whose resources are critical for the system functioning and may consequently exert an influence on its survival and evolutionary dynamics.

Therefore, economic sustainability refers to the operating structure, where the achievement of conditions of economic-structural efficiency is a priority. Social sustainability adopts a vision oriented towards the systemic effectiveness of the context. Environmental sustainability, by incorporating the political dimension, has a broader scope and refers to long-term survival and long-term systemic balance.

In summary, in a Viable Systems Approach perspective, the search for sustainability is to be attributed to the search for the right relationships (defined as consonance) and the right interactions (defined as resonance) with the other systems within a specific context.

Thus, based on this general framework, in the next section we will propose a critical and holistic analysis for a unified health assessment, in a complex decision-making scenarios, such as HTA, that can harmonize a variety of resources, skills, expertise, interests, and expectations, reconciling the typically opposite targets of efficiency, effectiveness, and sustainability [2].

3.2. A Systems Approach to Health Evaluation Methods

The analysis in Section 2 shows that the most widespread methodologies for health assessment are limited to one-dimensional measurements of efficiency, inspired by the simple relationship between costs and results. Among them, the most common evaluation methods used for the assessment of new medical devices or drugs are the cost-effectiveness-analysis (CEA) and the cost-utility analysis (CUA) [43].

CEA defines the outcomes of an innovation in medicine according to specific dimensions (for example: delay in aggravating a syndrome, deferral of the time of surgery, effects of prevention programs, etc.).

Instead, the outcomes of the CUA are measured as health-related preferences, described as Quality Adjusted Life Years (QALYs) or Quality Adjusted Life Expected (QALE) gained; in fact, this method assumes that health is a function of length and quality of life and combines these values into a single index number.

In addition to the most commonly used methods, many other propositions can be found in literature, some of which are also sporadically used by the agencies of the different countries.

Among them, the Cost Consequence Analysis (CCA) does not attempt to summarize outcomes in a single measure (such as the QALY) or in financial terms. Instead, its outcomes are shown in their natural units (some of which may be monetary) and it is left to decision-makers to determine whether a treatment is worth being carried out. Consequently, CCA poses on the evaluator the problem of aggregating, weighing, and evaluating the components, data, and outcomes.

Apart from CUA, which summarizes the effects of an initiative in QALY, both CEA and CCA are susceptible to a further step, consisting in the treatment of their results with the multi-criteria analysis (Multiple Criteria Decision Analysis, MCDA) that is recently expanding into the field of drug and health-related assessments [44–46]. The definition of MCDA encompasses a wide range of different approaches. However, Garattini and Padula [47] criticize its use in HTA, because the main intrinsic limit for health policy decisions on new technologies is the lack of key information at the early stage of market approval.

The databases that can be used, regardless of the evaluation method, comprise data from a variety of sources, including, but not limited to, clinical trials and observations. It is worth noting that there are two basic approaches to economic evaluation. In trial-based studies, economic data (e.g., resource utilization, and quality of life) are collected alongside a single clinical study, usually a controlled clinical trial. In modelling studies, data from a wide range of sources (e.g., existing clinical trials, observational studies) are synthesized using an economic model [12]; the authors also conclude that the two approaches are complementary and not mutually exclusive.

A separate analysis deserves the cost benefit analysis (CBA) which is not affected by the limitations of the efficiency measurements of the cited methods, being by its nature aimed at considering the complex impact that any investment (in our case in medicine) produces on the well-being of the community that benefits from it. However, the recognized difficulties in applying the cost-benefit analysis, mostly deriving from the ambition to assign a monetary value to each of the expected effects, is amplified in the case of innovations in health systems for a series of ethical issues that its application raises, first of all the ones related to the evaluation of human life [48,49].

We believe that the QALY/CUA can be used on the condition that the assertion of every QALY having the same value regardless of the condition or the personal characteristics of the population treated (age, sex, severity of disease, level of deprivation, or other characteristics) is exceeded. Therefore, the QALY, as a direct effect of the new technology, must be quantified in a systems perspective, such as the proposed one of the vSa, with reference to:

- the indirect effects, related not only to the patient, but also to the organization that provides care; and
- the indirect costs of the disease (e.g., caregivers, etc.), on the consequences of the patient's family entourage.

This, mainly, in order to overcome the first flaw identified by Drummond and Sculpher [12] consisting in the "omission of important costs or benefit". Furthermore, the sustainability of the process must be considered in terms of the anthropic environment regarding the entire life cycle.

Table 2 summarizes the different evaluation methods analysed so far and the related measures.

Table 2. Evaluation methods.

Methods	Measures
Cost Effectiveness Analysis (CEA)	Cost per unit change in output (e.g., cost per unit of social housing)
Cost Consequence Analysis (CCA) (or "Balance Sheet")	Listing of all major costs and outcomes in natural units
Cost Utility Analysis (CUA)	Cost per unit change in Quality Adjusted Life Year (QALY)
Cost Benefit Analysis (CBA)	Value all outcomes in a common unit (e.g., monetary units)

As emerges from Table 2, the most used evaluation methods for HTA consider measures usually related to effectiveness. The proposed theoretical view of HTA, by referring to vSa principles, considers sustainability intended as the consideration of the political dimension in the assessment procedures, together with the economic and social aspects [25].

With the term political sustainability, in fact, it is to be intended the development and maintenance of the political will necessary to sustain a major policy direction in the health care system [25,50].

The vSa and its conceptualizations highlight key elements that allow the definition of a more appropriate approach to Health Technology Assessment. In fact, the general view of vSa considers the different perspectives, the priorities, and the mechanisms of influence of all the suprasystems in the HTA.

Consistently with a vSa view, the viability of the Healthcare system linked to the inclusion of social and political dimensions implies the shift from Health Technology Assessment (HTA) to Health Technology Sustainability (HTS), as there cannot be healthcare sustainability without health technology sustainability, and vice versa [51].

Accordingly, from the above several implications derive:

- the consideration of all the dimensions of evaluation processes; in particular, efficiency and effectiveness are enhanced by including the sustainability perspective [2];
- because of the previous point, the simultaneous consideration of all the suprasystems involved in healthcare system, both as users and as decision-makers; and

- based on systems thinking, the evaluation of healthcare system in its both structural (efficiency perspective) and systemic (effectiveness and sustainability perspective) configuration.

In this regard, the proposed unified health assessment in a vSa framework presupposes the use of a new perspective that adds the political dimension to the pre-existing economic and social aspects, thus proposing an evaluation based on Cost per Unit Change expressed in terms of Quality Adjusted Life Year (QALY).

In line with the considerations proposed above, this new approach might be able to overcome the limitations of every QALY having the same value, thus quantifying the indirect effects of medical treatments, in a systems perspective.

4. Discussion, Limitations, and Future Lines of Research

The criticism of the methodological aspects of evaluating innovations in healthcare, and the continuous search for changes or alternatives to existing techniques seem to derive from the lack of awareness of the multiplicity of possible innovations with various characteristics, rather than from their intrinsic limitations. This means that for each of them it is necessary to identify the most appropriate methods among the existing ones. If, for innovations with high technological contents (e.g., high cost), and high social, economic and political impacts, a systems approach that considers the multiplicity of effects on the multiplicity of stakeholders involved is necessary, for procedural innovations of low cost and limited impact (for example procedures in the limited area of a hospital) simpler techniques are enough. This is also because evaluation procedures have costs that must be proportionate to the expected benefits. In this context, it should be noted that the cost of evaluation is mostly linked to the retrieval and systematization of data and information necessary for the evaluation itself, while only in residual part is attributable to the calculations. Whereas data and information can be used in different evaluation techniques, it is appropriate to apply them all: the result of each contributes to enrich the information flow for decision-makers.

Where replicated with reference to a larger sample (e.g., other disciplines, other areas, etc.), the analysis should be carried out employing different techniques, or a database able to exceed the limits of Scopus, connected to issues of duplications, delay in database update, and substantial costs [32].

Further limitations of present work could deal with the absence of a deeper analysis based on multivariate analysis on major components analysis, although Vosviewer Software still gives information about total link strength and citation, and closeness of data points.

Future lines of research will be focused on the number, the different nature, and the different degrees of complexity of innovation to be evaluated, as well as on the corresponding number and different nature of the decision-makers involved, whose decisions, depending on their role, produce effects on very different scales. This will imply the creation of a taxonomy of innovations, on one hand, and the analysis of roles and composition of decision-makers on the other. In fact, the possible numerous intersections between the objects (innovations) and the subjects (decision-makers) seem to be the starting point for the realization of reliable assessments, under the constraint of limited resources, and the related need to contain costs.

Supplementary Materials: The map is downloadable at the following link: https://bit.ly/2z9BCnd.

Author Contributions: Introduction: L.F.; Materials and Methods: V.P.; Results: I.F., F.I., L.F.; The Discussion and Conclusions section is the result of synergic final considerations.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Thesaurus used in the VosViewer elaboration.

Label	Replace By
Adolescent	Adolescent
Adult	Adult
Aged	Aged
Article	
Assessment method	Assessment method
Australia	
Biomedical technology	Health technology assessment
Biomedical technology assessment	Health technology assessment
Brazil	
Budget	Budget
Canada	
Child	Child
China	
Clinical decision-making	Clinical decision-making
Clinical practice	Clinical practice
Comparative study	Comparative study
Conceptual framework	Conceptual framework
Controlled study	Controlled study
Cost benefit analysis	Cost benefit analysis
Cost control	Cost control
Cost effectiveness analysis	Cost effectiveness analysis
Cost utility analysis	Cost utility analysis
Cost-benefit analysis	Cost benefit analysis
Cost-effectiveness	Cost effectiveness analysis
Cost-effectiveness analysis	Cost effectiveness analysis
Decision-making	decision-making
Decision-making, organizational	decision-making
Decision support system	Decision support system
Decision support techniques	Decision support system
Decision-making	decision-making
Delivery of health care	Delivery of health care
Devices	Devices
Diffusion of innovation	Diffusion of innovation
Documentation	Documentation
Drug	Drug
Drug cost	Drug costs
Drug costs	Drug costs
Drug efficacy	Drug efficacy
Drug industry	Drug industry
Drug manufacture	Drug manufacture
Drug marketing	Drug marketing
Drug policy	Drug policy
Drug safety	Drug safety
Economic aspect	Economic aspect
Economic evaluation	Economic evaluation
Economics	Economics
England	
Ethics	Ethics
Europe	
Evidence based medicine	Evidence based medicine
Evidence-based medicine	Evidence based medicine
Female	Female
Financial management	Financial management
Forecasting	Forecasting
France	
Funding	Funding
Generic drug	Generic drug
Germany	
Government	Government
Great britain	
Gross national product	Gross national product

Table A1. *Cont.*

Label	Replace By
Health care	Health care
Health care access	Health care access
Health care cost	Health care costs
Health care costs	Health care costs
Health care delivery	Health care delivery
Health care financing	Health care financing
Health care organization	Health care organization
Health care planning	Health care planning
Health care policy	Health care policy
Health care quality	Health care quality
Health care reform	Health care reform
Health care system	Health care system
Health care utilization	Health care utilization
Health economics	Health economics
Health impact assessment	Health impact assessment
Health insurance	Health insurance
Health policy	Health care policy
Health service	Health services
Health services	Health services
Health status	Health status
Health survey	Health survey
Health technology assessment	Health technology assessment
Health technology assessment (hta)	Health technology assessment
Health technology assessments	Health technology assessment
Hta	Health technology assessment
Human	
Humans	
Hungary	
Information processing	Information processing
Innovation	Innovation
Insurance	Insurance
Interview	
Law	Law
Literature	
Major clinical study	Major clinical study
Male	Male
Management	Management
Medical decision-making	Medical decision-making
Medical device	Medical devices
Medical devices	Medical devices
Medical ethics	Ethics
Medical research	Medical research
Medical technology	Medical technology
Methodology	
Middle aged	Middle aged
Models, economic	
National health programs	National health programs
National health service	National health service
Netherlands	
Oncology	
Organization	Organization
Organization and management	Organization and management
Outcome assessment	Outcome assessment
Outcome assessment (health care)	Outcome assessment
Patient preference	Patient preference
Pharmaceuticals	Pharmaceuticals
Pharmacoeconomics	Pharmacoeconomics
Poland	
Policy	Policy
Policy making	Policy making
Practice guideline	Practice guideline
Prescription	Prescription
Pricing	Pricing

Table A1. *Cont.*

Label	Replace By
Priority journal	
Procedures	Procedures
Public health	Public health
Public health service	Public health
Publication	
Qualitative research	
Quality adjusted life year	Quality adjusted life year
Quality control	Quality control
Quality of life	Quality of life
Quality-adjusted life years	Quality adjusted life year
Questionnaire	
Randomized controlled trial (topic)	Randomized controlled trial
Reimbursement	Reimbursement
Research design	
Resource allocation	Resource allocation
Review	
Review literature as topic	
Risk assessment	Risk assessment
Standard	Standards
Standards	Standards
State medicine	State medicine
Statistical analysis	Statistical analysis
Statistics and numerical data	Statistical analysis
Sweden	
Systematic review	
Technological development	Technological development
Technology	Technology
Technology assessment	Health technology assessment
Technology assessment, biomedical	Health technology assessment
Total quality management	Total quality management
Treatment outcome	Treatment outcome
Trends	Trends
Uncertainty	Uncertainty
United kingdom	
United states	
Wellbeing	Wellbeing

Appendix B

Table A2. Weights and Links strength of the references.

Id	Label	Url	x	y	Cluster	Weight <Links>	Weight <Total Link Strength>	Weight <Citations>	Weight <Norm. Citations>	Score <Pub. Year>	Score <Citations>	Score <Norm. Citations>
1	rutnam (1991)	https://doi.org/10.1080/08164649.1991.9994628	1.0023	2.2198	16	0	0	1	1.000	1991	1	1.000
2	smith (1994)	https://doi.org/10.1016/0277-9536(94)90067-1	1.9484	1.3767	17	0	0	6	0.947	1994	6	0.947
3	france (1994)	https://doi.org/10.1016/0277-9536(94)90064-7	0.6613	2.3638	18	0	0	3	0.474	1994	3	0.474
4	granados (1994)	https://doi.org/10.1016/0277-9536(94)90065-5	2.309	−0.5175	19	0	0	10	1.579	1994	10	1.579
5	freemantle (1995)	https://doi.org/10.1016/0277-9536(94)00272-u	2.204	0.8791	20	0	0	13	1.000	1995	13	1.000
6	reuzel (1999)	https://doi.org/10.1023/a:1009963018813	−0.9821	−2.3246	21	0	0	14	1.000	1999	14	1.000
7	jones (2000)	https://doi.org/10.1057/palgrave.jmm.5040022	−0.3431	0.0427	8	1	1	1	0.286	2000	1	0.286
8	reuzel (2000)	https://doi.org/10.1177/13563890022209389	−0.2478	0.0384	6	7	5	6	1.714	2000	6	1.714
9	jones (2001)	https://doi.org/10.1057/palgrave.jmm.5040041	−0.2421	−0.0874	4	1	1	0	0.000	2001	0	0.000
10	oliver (2001)	https://doi.org/10.1177/13563890122209847	−0.2387	0.1697	5	2	1	16	2.000	2001	16	2.000
11	wells (2002)	https://doi.org/10.1049/em:20020410	−0.0999	−0.1005	4	1	1	3	1.000	2002	3	1.000
12	jacobs (2003)	https://doi.org/10.1177/1044207303014002100 1	−0.3183	−0.0247	11	7	2	7	0.240	2003	7	0.240
13	aspinall (2003)	https://doi.org/10.1016/s0277-9536(02)00027-8	2.1339	1.0488	22	0	0	25	0.857	2003	25	0.857
14	may (2003)	https://doi.org/10.1016/s0277-9536(02)00419-7	−0.1394	0.1675	1	8	4	89	3.051	2003	89	3.051
15	sloane (2003)	https://doi.org/10.1016/s0305-0548(02)00187-9	−0.1546	−0.0002	11	1	2	51	1.749	2003	51	1.749
16	cohen (2003)	https://doi.org/10.1002/hec.791	−0.2579	−0.1468	2	3	3	2	0.069	2003	2	0.069
17	szucs (2003)	https://doi.org/10.1057/palgrave.jcb.3040064	−0.2471	−0.0797	4	6	5	1	0.034	2003	1	0.034
18	briggs (2004)	https://doi.org/10.2165/00148365-200403020-00004	−0.3095	−0.1748	3	11	8	29	1.000	2004	29	1.000
19	vázquez-polo (2005)	https://doi.org/10.1002/hec.947	−0.3572	−0.1971	3	5	8	11	0.454	2005	11	0.454
20	milewa (2005)	https://doi.org/10.1111/j.1467-9515.2005.00452.x	−0.3126	0.1284	5	14	10	26	1.072	2005	26	1.072
21	ginnelly (2005)	https://doi.org/10.2165/00148365-200504010-00006	−0.2972	−0.1484	3	12	11	25	1.031	2005	25	1.031
22	hofmann (2005)	https://doi.org/10.1007/s10202-005-0073-1	−0.1804	0.1491	1	16	10	35	1.443	2005	35	1.443
23	milewa (2006)	https://doi.org/10.1016/j.socscimed.2006.08.009	−0.3348	0.1431	5	9	14	19	1.000	2006	19	1.000
24	brown (2007)	https://doi.org/10.1057/palgrave.jmm.5050086	1.2452	−2.0779	23	0	0	12	1.000	2007	12	1.000
25	scheibler (2008)	https://doi.org/10.1016/j.zefq.2008.07.017	−0.2634	−0.0507	11	2	2	5	1.333	2008	5	1.333
26	hoppe (2008)	https://doi.org/10.1111/j.1467-8691.2008.00495.x	−0.1427	0.2134	1	3	3	5	1.333	2008	5	1.333
27	lehoux (2008)	https://doi.org/10.1177/1356389008090857	−0.2077	0.1455	1	21	17	4	1.067	2008	4	1.067
28	freemantle (2008)	https://doi.org/10.1007/s10198-008-0123-4	−0.1887	−0.2168	2	2	3	1	0.267	2008	1	0.267
29	sacchini (2009)	https://doi.org/10.1007/s11019-009-9206-y	−0.1283	0.2168	1	17	12	13	0.944	2009	13	0.944
30	göhlen (2009)	https://doi.org/10.1016/j.zefq.2009.06.015	1.2087	2.1022	24	0	0	0	0.000	2009	0	0.000
31	vespermann (2009)	https://doi.org/10.1016/j.zefq.2009.06.008	2.0483	1.2143	25	0	0	0	0.000	2009	0	0.000
32	wild (2009)	https://doi.org/10.1016/j.zefq.2009.06.010	2.3075	0.5343	26	0	0	0	0.000	2009	0	0.000
33	schwarzer (2009)	https://doi.org/10.1016/j.zefq.2009.05.020	−0.2724	−0.1973	3	1	1	2	0.145	2009	2	0.145
34	welton (2009)	https://doi.org/10.1111/j.1467-985x.2008.00548.x	−0.199	−0.1982	2	4	5	62	4.500	2009	62	4.500
35	lehoux (2009)	https://doi.org/10.1016/j.socscimed.2009.03.017	−0.1648	0.1546	1	13	10	37	2.686	2009	37	2.686
36	gammon (2009)	https://doi.org/10.1136/jme.2008.027920	−0.1254	0.2055	1	11	4	7	0.508	2009	7	0.508
37	moreno (2009)	https://doi.org/10.1080/13571510903227056	−0.3567	−0.1939	3	5	7	3	0.218	2009	3	0.218
38	groop (2010)		−0.2386	−0.1609	2	5	3	6	0.465	2010	6	0.465
39	strech (2010)	https://doi.org/10.1016/j.zefq.2010.03.001	−0.288	−0.0565	2	10	4	2	0.155	2010	2	0.155
40	boenink (2010)	https://doi.org/10.1007/s11019-009-9223-x	−0.1443	0.2025	1	15	6	27	2.093	2010	27	2.093
41	bührlen (2010)	https://doi.org/10.1016/j.zefq.2010.10.012	−0.2486	0.0812	6	21	9	1	0.078	2010	1	0.078
42	koivisto (2010)	https://doi.org/10.1332/174426410$\times$482980	−0.1949	0.135	1	14	7	4	0.310	2010	4	0.310
43	torbica (2010)	https://doi.org/10.1057/jmm.2009.48	−0.2188	−0.0673	4	8	3	11	0.853	2010	11	0.853
44	allen (2010)	https://doi.org/10.3109/01421590903390619	0.2806	2.4565	27	0	0	1	0.078	2010	1	0.078
45	bridges (2010)	https://doi.org/10.1108/s0731-2199(2010)0000022005	−0.4454	−0.0092	7	11	12	12	0.930	2010	12	0.930
46	woodman (2010)	https://doi.org/10.3163/1536-5050.98.2.006	1.5576	1.8341	28	0	0	8	0.620	2010	8	0.620

Table A2. *Cont.*

Id	Label	Url	x	y	Cluster	Weight <Links>	Weight <Total Link Strength>	Weight <Citations>	Weight <Norm. Citations>	Score <Pub. Year>	Score <Citations>	Score <Norm. Citations>
47	gauvin (2010)	https://doi.org/10.1016/j.socscimed.2010.01.036	−0.1958	0.1599	1	36	24	57	4.419	2010	57	4.419
48	martin (2011)	https://doi.org/10.4067/s1726-569$\times$2011000200009	−0.1584	0.1717	1	22	9	1	0.060	2011	1	0.060
49	czech (2011)	https://doi.org/10.14254/2071-789x.2011/4-1a/8	−0.5471	0.0001	10	2	2	0	0.000	2011	0	0.000
50	brousselle (2011)	https://doi.org/10.1016/j.socscimed.2011.01.008	−0.3098	0.0323	6	39	27	33	1.976	2011	33	1.976
51	drummond (2011)	https://doi.org/10.1007/s10198-010-0274-y	−0.3244	0.0744	6	1	1	37	2.216	2011	37	2.216
52	jarosławski (2011)	https://doi.org/10.2165/11592960-000000000-00000	−0.561	0.0202	10	2	1	6	0.359	2011	6	0.359
53	bombard (2011)	https://doi.org/10.1016/j.socscimed.2011.04.017	−0.1556	0.1892	1	31	21	35	2.096	2011	35	2.096
54	walters (2011)	https://doi.org/10.1080/02664763.2010.545375	−0.5061	0.0147	10	1	1	2	0.120	2011	2	0.120
55	goeree (2011)	https://doi.org/10.2147/ceor.s14404	−0.3672	−0.051	4	3	5	36	2.156	2011	36	2.156
56	orlewska (2011)	https://doi.org/10.1556/socec.33.2011.3.8	−0.6368	−0.1509	13	4	7	3	0.180	2011	3	0.180
57	meltzer (2011)	https://doi.org/10.1016/b978-0-444-53592-4.00007-4	−0.2879	−0.0226	6	25	13	14	0.838	2011	14	0.838
58	droste (2012)	https://doi.org/10.1016/j.zefq.2012.05.019	−0.13	0.2185	1	10	2	2	0.222	2012	2	0.222
59	kelly (2012)	https://doi.org/10.1057/sth.2011.21	−0.2728	0.0231	6	20	6	29	3.222	2012	29	3.222
60	boenink (2012)	https://doi.org/10.1007/s10728-011-0173-0	−0.2148	0.121	1	21	14	3	0.333	2012	3	0.333
61	jommi (2012)	https://doi.org/10.1177/1745790412440704	−0.5812	0.0278	10	3	3	3	0.333	2012	3	0.333
62	kuchenbecker (2012)	https://doi.org/10.1016/j.vhri.2012.09.009	−0.3636	0.0516	7	8	5	8	0.889	2012	8	0.889
63	augustovski (2012)	https://doi.org/10.1016/j.vhri.2012.09.007	−0.4075	0.0654	7	1	1	5	0.556	2012	5	0.556
64	vargas-zea (2012)	https://doi.org/10.1016/j.vhri.2012.09.004	2.358	0.1837	29	0	0	13	1.444	2012	13	1.444
65	siebert (2013)	https://doi.org/10.1016/j.zefq.2013.10.020	−0.3448	−0.1338	3	14	12	11	1.133	2013	11	1.133
66	perleth (2013)	https://doi.org/10.1016/j.zefq.2013.04.006	−0.2862	−0.0864	4	17	6	1	0.103	2013	1	0.103
67	wild (2013)	https://doi.org/10.1016/j.zefq.2013.02.008	−0.3427	−0.0319	2	3	4	1	0.103	2013	1	0.103
68	eckermann (2013)	https://doi.org/10.1016/j.socscimed.2012.10.020	−0.3497	−0.1116	3	21	7	7	0.721	2013	7	0.721
69	spinner (2013)	https://doi.org/10.2147/ceor.s39624	−0.3627	0.0567	5	31	13	14	1.442	2013	14	1.442
70	smith (2013)	https://doi.org/10.1177/1745790413476876	−0.1785	−0.074	9	8	5	3	0.309	2013	3	0.309
71	niewada (2013)	https://doi.org/10.1016/j.vhri.2013.05.002	−0.3032	0.008	12	11	5	8	0.824	2013	8	0.824
72	odame (2013)	https://doi.org/10.1016/j.vhri.2013.07.006	−0.3549	−0.0125	7	26	9	5	0.515	2013	5	0.515
73	petrou (2013)	https://doi.org/10.1016/j.vhri.2013.06.016	−0.2596	−0.0383	4	4	3	13	1.339	2013	13	1.339
74	sura (2013)	https://doi.org/10.1016/j.vhri.2013.06.012	1.9613	−1.3558	30	0	0	1	0.103	2013	1	0.103
75	kaló (2013)	https://doi.org/10.1016/j.vhri.2013.06.002	−0.6073	−0.1402	13	3	4	27	2.782	2013	27	2.782
76	elsisi (2013)	https://doi.org/10.1016/j.vhri.2013.06.014	−0.3557	−0.0197	11	17	6	7	0.721	2013	7	0.721
77	salvatore (2013)	https://doi.org/10.1177/1745790413498410	−0.1837	−0.0458	4	9	5	0	0.000	2013	0	0.000
78	thébaut (2013)	https://doi.org/10.1016/j.socscimed.2013.10.020	−0.2687	−0.0791	2	7	6	3	0.309	2013	3	0.309
79	hevér (2013)	https://doi.org/10.1556/socec.2013.0008	−0.6075	−0.1331	13	6	8	1	0.103	2013	1	0.103
80	attema (2013)	https://doi.org/10.1007/s10198-013-0508-x	−0.2782	−0.0913	2	11	9	36	3.709	2013	36	3.709
81	ulucanlar (2013)	https://doi.org/10.1016/j.socscimed.2013.09.008	−0.1574	0.1045	1	15	11	27	2.782	2013	27	2.782
82	neyt (2014)	https://doi.org/10.3917/rpve.534.0055	−0.2916	−0.0018	6	18	2	0	0.000	2014	0	0.000
83	ríos (2014a)	https://doi.org/10.1016/j.vhri.2014.02.005	0.6749	−2.3566	15	1	4	0	0.000	2014	0	0.000
84	ríos (2014b)	https://doi.org/10.1016/j.vhri.2014.08.002	0.6755	−2.3563	15	1	4	1	0.157	2014	1	0.157
85	jain (2014)	https://doi.org/10.1016/j.vhri.2014.04.006	−0.3537	0.0247	7	10	7	1	0.157	2014	1	0.157
86	gulácsi (2014)	https://doi.org/10.1007/s10198-014-0590-8	−0.3691	0.0678	8	5	5	32	5.016	2014	32	5.016
87	kennedy-martin (2014)	https://doi.org/10.1016/j.vhri.2014.03.001	−0.3809	0.0229	8	17	8	5	0.784	2014	5	0.784
88	hunger (2014)	https://doi.org/10.1007/s00038-013-0494-x	−0.399	−0.1522	3	2	1	1	0.157	2014	1	0.157
89	jakubiak-lasocka (2014)	https://doi.org/10.1016/j.vhri.2014.06.008	−0.3366	−0.0218	11	10	4	11	1.724	2014	11	1.724
90	böhm (2014)	https://doi.org/10.1080/07036337.2013.793679	−0.3527	−0.0619	3	7	3	8	1.254	2014	8	1.254

Table A2. *Cont.*

Id	Label	Url	x	y	Cluster	Weight <Links>	Weight <Total Link Strength>	Weight <Citations>	Weight <Norm. Citations>	Score <Pub. Year>	Score <Citations>	Score <Norm. Citations>
91	elias (2014)	https://doi.org/10.1016/j.zefq.2014.08.021	−0.3841	0.0612	7	2	4	2	0.314	2014	2	0.314
92	madan (2014)	https://doi.org/10.1111/rssa.12018	−0.1944	−0.2018	2	5	7	9	1.411	2014	9	1.411
93	cerri (2014)	https://doi.org/10.1007/s10198-013-0514-z	−0.3005	0.0907	6	7	5	10	1.568	2014	10	1.568
94	skoupá (2014)	https://doi.org/10.1016/j.vhri.2014.06.003	−0.429	−0.1091	13	3	2	10	1.568	2014	10	1.568
95	gorenoi (2014)	https://doi.org/10.1016/j.zefq.2014.03.017	−0.2066	−0.162	2	6	7	0	0.000	2014	0	0.000
96	mendonça (2014)	https://doi.org/10.1007/s10198-013-0522-z	1.5818	−1.8096	31	0	0	3	0.470	2014	3	0.470
97	lopert (2014)	https://doi.org/10.1016/j.zefq.2014.08.020	−0.3964	0.0986	5	5	2	1	0.157	2014	1	0.157
98	daniel mullins (2014)	https://doi.org/10.1016/j.vhri.2014.02.006	−0.3253	−0.0512	4	11	13	4	0.627	2014	4	0.627
99	horváth cs.z. (2014)	https://doi.org/10.1007/s10198-014-0601-9	−0.6504	−0.1549	13	2	4	5	0.784	2014	5	0.784
100	tetteh (2014)	https://doi.org/10.1186/s13561-014-0026-2	−0.3634	−0.0993	3	6	2	1	0.157	2014	1	0.157
101	heintz (2014)	https://doi.org/10.1016/j.zefq.2014.09.006	−0.5044	−2.454	32	0	0	0	0.000	2014	0	0.000
102	abrishami (2014)	https://doi.org/10.1016/j.socscimed.2014.07.046	−0.1706	0.0643	9	12	7	9	1.411	2014	9	1.411
103	gurtner (2014)	https://doi.org/10.1097/hmr.0b013e3182993b91	−0.2725	−0.0189	11	30	9	9	1.411	2014	9	1.411
104	mitton (2014)	https://doi.org/10.1007/s40258-013-0074-5	−0.2622	−0.0655	11	12	8	23	3.605	2014	23	3.605
105	walzer (2014)	https://doi.org/10.2147/ceor.s53601	1.7058	1.688	33	0	0	9	1.411	2014	9	1.411
106	rogers (2014)	https://doi.org/10.1111/j.1467-8519.2012.01980.x	−0.0998	−0.1004	4	1	1	2	0.314	2014	2	0.314
107	li (2014)	https://doi.org/10.1016/j.vhri.2013.04.001	−0.3843	0.0386	8	6	3	1	0.157	2014	1	0.157
108	rader (2014)	https://doi.org/10.1002/jrsm.1097	−0.113	0.3162	14	1	1	14	2.195	2014	14	2.195
109	robertson (2014)	https://doi.org/10.1002/jrsm.1102	−0.193	−0.182	2	5	2	5	0.784	2014	5	0.784
110	pieper (2014)	https://doi.org/10.1002/jrsm.1107	−0.2253	−0.1384	2	5	7	9	1.411	2014	9	1.411
111	siebert (2015)	https://doi.org/10.1016/j.zefq.2015.06.012	−0.4021	−0.1473	3	4	2	4	0.656	2015	4	0.656
112	schnell-inderst (2015)	https://doi.org/10.1016/j.zefq.2015.06.011	−0.1153	−0.0927	4	11	6	10	1.639	2015	10	1.639
113	stürzlinger (2015)	https://doi.org/10.1016/j.zefq.2015.07.002	1.0457	−2.1952	34	0	0	0	0.000	2015	0	0.000
114	ivlev (2015)	https://doi.org/10.1016/j.ejor.2015.05.075	−0.2275	−0.0303	9	16	9	19	3.115	2015	19	3.115
115	wang (2015)	https://doi.org/10.1093/hrlr/ngv025	1.3938	1.9738	35	0	0	1	0.164	2015	1	0.164
116	pfadenhauer (2015)	https://doi.org/10.1016/j.zefq.2015.01.004	−0.1431	0.1065	1	5	3	18	2.951	2015	18	2.951
117	nachtnebel (2015)	https://doi.org/10.1016/j.zefq.2015.05.012	−0.1566	0.23	1	3	2	2	0.328	2015	2	0.328
118	rao (2015)	https://doi.org/10.5912/jcb669	−0.5469	0.037	10	3	1	1	0.164	2015	1	0.164
119	cuijpers (2015)	https://doi.org/10.1016/j.techfore.2014.03.006	2.3655	0.0078	36	0	0	9	1.475	2015	9	1.475
120	peine (2015)	https://doi.org/10.1016/j.techfore.2014.08.019	−0.1561	0.1296	1	7	6	4	0.656	2015	4	0.656
121	cook (2015)	https://doi.org/10.1016/j.vhri.2015.03.013	−0.3957	−0.0039	8	4	4	1	0.164	2015	1	0.164
122	lopes (2015)	https://doi.org/10.1016/j.socscimed.2015.04.021	−0.2795	0.1043	5	34	15	5	0.820	2015	5	0.820
123	rocchi (2015)	https://doi.org/10.2147/ceor.s82549	−2.1628	1.3879	37	0	0	5	0.820	2015	5	0.820
124	kolominsky-rabas (2015)	https://doi.org/10.1016/j.techfore.2013.12.005	−0.1868	−0.0957	9	16	12	12	1.967	2015	12	1.967
125	griffiths (2015)	https://doi.org/10.2147/ceor.s87462	−0.3785	0.0421	5	25	8	7	1.148	2015	7	1.148
126	dranitsaris (2015)	https://doi.org/10.1007/s40258-014-0130-9	−0.4767	0.0379	10	19	6	7	1.148	2015	7	1.148
127	petrou (2015)	https://doi.org/10.1007/s40258-015-0191-4	−0.2727	−0.0473	7	3	3	0	0.000	2015	0	0.000
128	winnette (2015)	https://doi.org/10.1016/j.vhri.2015.03.008	−0.4524	0.0066	7	3	3	1	0.164	2015	1	0.164
129	bitencourt (2015)	https://doi.org/10.1016/j.vhri.2015.08.002	2.1415	−1.0297	38	0	0	3	0.492	2015	3	0.492
130	brazier (2015)	https://doi.org/10.1007/s40258-015-0194-1	−0.2521	−0.0961	2	6	7	13	2.131	2015	13	2.131
131	sacchini (2016)		−0.1442	0.2087	1	23	20	0	0.000	2016	0	0.000
132	wortley (2016)	https://doi.org/10.1108/jhom-08-2015-0119	−0.2717	0.0556	5	38	22	1	0.309	2016	1	0.309
133	peregrin (2016)	https://doi.org/10.1504/ijbsr.2016.075746	−0.1731	−0.0022	11	10	8	0	0.000	2016	0	0.000
134	petrillo (2016)	https://doi.org/10.1504/ijmcdm.2016.077878	−0.2622	0.0267	11	10	11	1	0.309	2016	1	0.309
135	manelli (2016)		−0.2554	0.0602	6	20	5	0	0.000	2016	0	0.000
136	brown (2016)	https://doi.org/10.1177/0306312715609699	−0.4162	0.1269	5	2	2	7	2.162	2016	7	2.162
137	babigumira (2016)	https://doi.org/10.1111/jphs.12120	−0.3355	0.0036	7	6	7	2	0.618	2016	2	0.618
138	lysdahl (2016)	https://doi.org/10.1186/s12910-016-0099-z	−0.1371	0.1632	1	18	11	2	0.618	2016	2	0.618

Table A2. *Cont.*

Id	Label	Url	x	y	Cluster	Weight <Links>	Weight <Total Link Strength>	Weight <Citations>	Weight <Norm. Citations>	Score <Pub. Year>	Score <Citations>	Score <Norm. Citations>
139	koh (2016)	https://doi.org/10.1016/j.vhri.2015.06.004	1.4224	−1.9477	39	0	0	6	1.853	2016	6	1.853
140	dang (2016)	https://doi.org/10.1016/j.vhri.2015.11.005	−0.3974	0.0107	7	13	8	4	1.235	2016	4	1.235
141	dilokthornsakul (2016)	https://doi.org/10.1016/j.vhri.2015.12.003	−0.3584	−0.1186	3	10	8	1	0.309	2016	1	0.309
142	mühlbacher (2016)	https://doi.org/10.1007/s40258-016-0232-7	−0.1706	−0.0797	9	15	10	21	6.485	2016	21	6.485
143	assasi (2016)	https://doi.org/10.1186/s12910-016-0118-0	−0.138	0.2677	14	20	18	1	0.309	2016	1	0.309
144	sullivan (2016)	https://doi.org/10.1007/s10198-015-0720-y	2.2618	0.7075	40	0	0	6	1.853	2016	6	1.853
145	thompson (2016)	https://doi.org/10.2147/ceor.s96616	−0.5617	0.0341	10	5	6	0	0.000	2016	0	0.000
146	radu (2016)	https://doi.org/10.1016/j.vhri.2016.07.006	−0.3752	0.0754	8	1	1	4	1.235	2016	4	1.235
147	grundy (2016)	https://doi.org/10.1016/j.socscimed.2016.07.042	−0.252	−0.0145	7	8	9	1	0.309	2016	1	0.309
148	panayidou (2016)	https://doi.org/10.1002/jrsm.1202	−0.274	−0.1742	3	4	8	5	1.544	2016	5	1.544
149	tsiachristas (2016)	https://doi.org/10.5334/ijic.2472	−0.2259	−0.0147	12	27	8	4	1.235	2016	4	1.235
150	meyer (2016)	https://doi.org/10.1016/j.zefq.2016.07.011	−0.1628	−0.1172	9	1	1	0	0.000	2016	0	0.000
151	janssen (2016)	https://doi.org/10.2147/ppa.s122319	−0.1999	−0.0711	2	15	7	2	0.618	2016	2	0.618
152	ducey (2017)	https://doi.org/10.1332/174426415$\times$14443053123024	−0.1692	0.1577	1	28	22	0	0.000	2017	0	0.000
153	callea (2017)	https://doi.org/10.1016/j.socscimed.2016.11.038	−0.1549	−0.025	4	7	6	4	1.892	2017	4	1.892
154	wright (2017)	https://doi.org/10.1111/1758-5899.12215	−0.4475	−0.0246	10	14	15	0	0.000	2017	0	0.000
155	mühlbacher (2017)	https://doi.org/10.1007/s10198-016-0763-8	−0.1563	−0.0791	9	5	9	8	3.784	2017	8	3.784
156	blome (2017)	https://doi.org/10.1007/s10198-016-0765-6	−0.4683	−0.0188	10	2	2	0	0.000	2017	0	0.000
157	castro (2017)	https://doi.org/10.1111/1758-5899.12333	−0.3354	0.0339	8	21	9	1	0.473	2017	1	0.473
158	mossman (2017)	https://doi.org/10.1111/1758-5899.12221	−0.2374	0.0693	5	4	2	0	0.000	2017	0	0.000
159	kanavos (2017)	https://doi.org/10.1111/1758-5899.12386	−0.5595	0.0198	10	8	12	3	1.419	2017	3	1.419
160	hensher (2017)	https://doi.org/10.1016/j.socscimed.2017.01.020	−0.3613	−0.0928	3	3	1	3	1.419	2017	3	1.419
161	thijssen (2017)	https://doi.org/10.1016/j.jedc.2017.01.016	−0.1679	−0.0085	9	3	3	1	0.473	2017	1	0.473
162	jakubczyk (2017)	https://doi.org/10.1007/s10479-015-1910-9	−0.3707	−0.1213	3	21	13	5	2.365	2017	5	2.365
163	markiewicz (2017)	https://doi.org/10.5912/jcb780	−0.1928	−0.0632	9	21	6	1	0.473	2017	1	0.473
164	gyalrong-steur (2017)	https://doi.org/10.1016/j.zefq.2017.01.002	1.8356	1.536	41	0	0	0	0.000	2017	0	0.000
165	hofmann (2017)	https://doi.org/10.1007/s11948-016-9791-0	−0.1316	0.2436	1	11	6	2	0.946	2017	2	0.946
166	greer (2017)	https://doi.org/10.1057/cep.2016.6	−0.3111	0.0516	8	23	8	2	0.946	2017	2	0.946
167	nicod (2017)	https://doi.org/10.1007/s10198-016-0823-0	−0.4591	0.0102	10	28	18	12	5.676	2017	12	5.676
168	rautenberg (2017)	https://doi.org/10.2147/ceor.s140902	−0.367	−0.1346	3	1	1	1	0.473	2017	1	0.473
169	cowles (2017)	https://doi.org/10.1007/s40258-017-0309-y	−0.3315	0.0075	8	15	7	2	0.946	2017	2	0.946
170	angelis (2017)	https://doi.org/10.1016/j.socscimed.2017.06.024	−0.2626	−0.0563	12	31	24	7	3.311	2017	7	3.311
171	inotai (2017)	https://doi.org/10.1016/j.vhri.2017.06.003	−0.5388	−0.1163	13	8	7	2	0.946	2017	2	0.946
172	brixner (2017)	https://doi.org/10.1016/j.vhri.2017.02.001	−0.2531	−0.0401	12	17	16	3	1.419	2017	3	1.419
173	skoupá (2017)	https://doi.org/10.1016/j.vhri.2017.08.002	1.7247	−1.6649	42	0	0	1	0.473	2017	1	0.473
174	yagudina (2017)	https://doi.org/10.1016/j.vhri.2017.07.006	−0.4697	0.0632	5	1	1	1	0.473	2017	1	0.473
175	dimova (2017)	https://doi.org/10.1016/j.vhri.2017.08.001	2.2091	−0.8607	43	0	0	2	0.946	2017	2	0.946
176	culig (2017)	https://doi.org/10.1016/j.vhri.2017.07.005	−0.4386	2.4633	44	0	0	1	0.473	2017	1	0.473
177	jahnz-różyk (2017)	https://doi.org/10.1016/j.vhri.2017.07.001	2.3408	−0.3436	45	0	0	3	1.419	2017	3	1.419
178	silins (2017)	https://doi.org/10.1016/j.vhri.2017.08.006	−1.7813	−1.8328	46	0	0	2	0.946	2017	2	0.946
179	chambers (2017)		−0.4242	0.1111	5	6	3	1	0.473	2017	1	0.473
180	knott (2017)	https://doi.org/10.1016/j.socscimed.2017.08.033	−0.2469	−0.1106	2	1	2	0	0.000	2017	0	0.000
181	mertz (2017)	https://doi.org/10.1016/j.zefq.2017.07.010	−0.1115	0.3164	14	1	3	0	0.000	2017	0	0.000
182	donin (2017)	https://doi.org/10.3846/16111699.2017.1409798	−0.1875	−0.0608	9	7	9	1	0.473	2017	1	0.473
183	rawson (2017)	https://doi.org/10.2147/ceor.s144695	−0.2916	0.1078	6	4	7	2	0.946	2017	2	0.946
184	rosselli (2017)	https://doi.org/10.1016/j.vhri.2017.02.004	−0.3833	0.0498	7	28	13	1	0.473	2017	1	0.473

Table A2. *Cont.*

Id	Label	Url	x	y	Cluster	Weight <Links>	Weight <Total Link Strength>	Weight <Citations>	Weight <Norm. Citations>	Score <Pub. Year>	Score <Citations>	Score <Norm. Citations>
185	kibel (2017)	https://doi.org/10.1016/j.socscimed.2017.11.024	−0.2257	−0.0132	2	10	6	1	0.473	2017	1	0.473
186	paolucci (2017)	https://doi.org/10.1007/s40258-017-0349-3	−0.2708	−0.0197	12	14	9	1	0.473	2017	1	0.473
187	angelis (2018)	https://doi.org/10.1007/s10198-017-0871-0	−0.3359	0.0181	12	42	37	5	6.500	2018	5	6.500
188	klímová (2018)	https://doi.org/10.15240/tul/001/2018-1-008	−0.202	−0.0593	9	21	7	0	0.000	2018	0	0.000
189	castro (2018)	https://doi.org/10.1590/1807-57622016.0549	−0.197	0.0503	5	27	16	0	0.000	2018	0	0.000
190	chen (2018a)	https://doi.org/10.5582/bst.2018.01038	−0.3881	0.0496	8	7	3	0	0.000	2018	0	0.000
191	löblová (2018)	https://doi.org/10.1111/psj.12213	−0.3518	0.0459	8	18	7	3	3.900	2018	3	3.900
192	wong (2018)	https://doi.org/10.1007/s40258-017-0339-5	−0.4439	0.0517	5	16	11	0	0.000	2018	0	0.000
193	fierlbeck (2018)	https://doi.org/10.1111/capa.12253	−0.2639	0.0924	6	16	15	0	0.000	2018	0	0.000
194	rehfuess (2018)	https://doi.org/10.1002/jrsm.1254	−0.1636	0.0294	12	5	4	5	6.500	2018	5	6.500
195	nord (2018)	https://doi.org/10.1007/s10198-017-0882-x	−0.3253	−0.0257	6	8	4	2	2.600	2018	2	2.600
196	yi (2018)	https://doi.org/10.2147/tcrm.s163190	−0.197	−0.162	2	5	2	0	0.000	2018	0	0.000
197	zhen (2018)	https://doi.org/10.1016/j.vhri.2018.01.010	−0.3836	0.0407	8	10	6	0	0.000	2018	0	0.000
198	chen (2018b)	https://doi.org/10.1016/j.techfore.2018.01.033	−0.1611	−0.0277	9	2	2	1	1.300	2018	1	1.300
199	chen (2018c)	https://doi.org/10.1016/j.vhri.2018.03.004	2.2668	−0.6904	47	0	0	0	0.000	2018	0	0.000
200	thornton snider (2018)	https://doi.org/10.1515/fhep-2016-0014	1.8509	−1.5132	48	0	0	0	0.000	2018	0	0.000
201	olofsson (2018)	https://doi.org/10.1007/s10198-017-0922-6	−0.3437	−0.0018	6	7	4	1	1.300	2018	1	1.300
202	kyle (2018)	https://doi.org/10.1007/s11151-018-9639-7	−1.0899	2.2796	49	0	0	1	1.300	2018	1	1.300
203	al rabayah (2018)	https://doi.org/10.1111/jphs.12241	−0.3556	−0.0638	13	17	5	0	0.000	2018	0	0.000
204	zegeye (2018)	https://doi.org/10.1016/j.vhri.2018.07.001	−0.3092	−0.0138	7	6	6	0	0.000	2018	0	0.000
205	brixner (2018)	https://doi.org/10.1016/j.vhri.2018.01.003	−0.2265	−0.0518	12	9	7	2	2.600	2018	2	2.600
206	radu (2018)	https://doi.org/10.1016/j.vhri.2017.11.003	2.3392	0.3594	50	0	0	0	0.000	2018	0	0.000
207	prasolov (2018)	https://doi.org/10.1016/j.vhri.2018.04.002	2.3583	−0.1679	51	0	0	0	0.000	2018	0	0.000
208	yfantopoulos (2018)	https://doi.org/10.1016/j.vhri.2018.06.006	−0.1402	−0.0268	4	1	1	0	0.000	2018	0	0.000
209	mägi (2018)	https://doi.org/10.1016/j.vhri.2017.10.001	2.0584	−1.1946	52	0	0	0	0.000	2018	0	0.000
210	palozzi (2018)	https://doi.org/10.3390/su10103550	−0.2471	0.0048	4	31	16	0	0.000	2018	0	0.000
211	espinoza (2018)	https://doi.org/10.1016/j.vhri.2018.07.003	−0.2227	−0.0464	12	10	3	0	0.000	2018	0	0.000
212	calderón (2018)	https://doi.org/10.1016/j.vhri.2018.01.011	−0.1967	−0.1695	2	5	3	0	0.000	2018	0	0.000

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