Can the global uptake of palliative care innovations be improved? Insights from a bibliometric analysis of the Edmonton Symptom Assessment System

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Abstract

Clinical research is undertaken to improve care for palliative patients, but little is known about how to support the broad uptake of resultant innovations. The objectives of this paper are to: (1) explore the uptake of the Edmonton Symptom Assessment System throughout the global palliative care community through the lens of a bibliometric review – a research method that maps out the journey of new knowledge uptake by evaluating where key articles are cited in published literature; (2) construct hypotheses on attributes of the global community of palliative care learners; and (3) make inferences on approaches that could improve knowledge transfer. While preliminary, results of the study suggest several specific approaches that could support widespread uptake of innovations in palliative care: targeting publication in high impact, international journals; explicitly focusing on how the innovation is applied to best practice; encouraging additional research to expand on early studies; consciously targeting key professional groups and organizations to promote discussion in the grey literature; and early translation and promotion within multiple languages.

Bibliographic Information

Introduction

Assessment and management of symptoms are central goals of palliative care.[1] Dissemination and uptake of new knowledge are integral to promoting quality of care in palliative care sites and settings. While evidence- based innovative approaches for assessment and management of symptoms are widely used in palliative care, little research has examined how research findings circulate and are taken up into practice. A more accurate understanding of how innovations, ideas that stimulate change in practice, are effectively communicated would inform knowledge dissemination strategies;[2] delineation of the patterns and channels of learning in palliative care communities can help researchers explicitly apply principles of knowledge transfer to support effective and rapid uptake of innovations. The question is, what channels of communication, targeting which early adopters, most effectively promote diffusion of innovations in palliative care?

Bibliometrics consists of a set of methods and procedures used in the quantification of bibliographic records (i.e. the basic units of measurement are bibliographic records of peer-reviewed publications). Bibliometrics, through the use of citation network analysis, can be used to study the pattern of flow of published material within a field, a process distinct from systematic reviews, which give critical appraisal to evidence within a specific field of knowledge.[3–5] Combined with an investigation of the knowledge disclosed within the peer-reviewed papers being measured, bibliometrics can be used to map knowledge uptake over time by evaluating how key articles are cited within published literature and to characterize the nature of the uptake by investigating the reasons behind citation. Analysis of publication patterns provides insight into how innovations are diffused, identifies professional communities or networks that support knowledge transfer, supports inferences on attributes of the broad community of learners, and thereby helps predict the most effective dissemination strategies.[6,7]

An example of a practice-changing assessment tool used by palliative care providers is the Edmonton Symptom Assessment System (ESAS). With the index paper published in 1991 by Bruera et al.,[8] the ESAS is based on researcher experience with daily use of visual analogue scales (VAS) to measure symptoms. Developed as a simple, rapidly applied assessment tool to give voice to common symptoms of cancer patients, the ESAS has been widely applied in a range of clinical settings and by diverse professional groups and cultures. It is acknowledged as a practice-changing tool, facilitating routine screening for symptoms in at-risk populations.[9]

The objective of this project was to explore the successful journey of the ESAS, from initial publication to widespread uptake and use around the world, in the assessment and care of patients. By analysing uptake of this tool, the application of bibliometric methods can allow investigators to map which channels it was adopted through, identify attributes of this community of learners, and by inference, develop insight into which factors can promote uptake of future innovations in palliative care. Armed with this information, palliative care researchers can be more explicit in developing knowledge transfer strategies for innovations in care.

Methods

Peer-reviewed literature search

Science-Metrix (Montreal, Quebec) specializes in the measurement and evaluation of science, technology and innovation, and thus was contracted to conduct data collection and initial analyses. Science-Metrix has in-house versions of most of the major databases of peer-reviewed scientific literature (e.g. Elsevier Scopus abstract and citation database, Thomson Reuters' Web of Science

(WoS) and Medline) on its own servers. These structured query language (SQL) relational databases have been conditioned to produce bibliometric indicators (i.e. bibliographic data has been cleaned and standardized).

In this study, Scopus was retained as the primary database, since it offers the broadest coverage of scientific literature within the health sciences while allowing for the search of documents citing the ESAS papers through a cited reference search (CRS). The peer-reviewed literature search strategy was selected in consultation with the authors. Firstly, documents citing the index ESAS paper were retrieved from Scopus through a CRS. To retrieve documents making an uncited reference to the ESAS paper, keyword searches were performed in the titles, author keywords and abstracts of papers in Scopus. The keywords used in the searches were: '%edmon%sym%ass%sys%', '%edmon%sym% ass%sca%' and '%ESAS%' (where % is a wild card). All documents retrieved using this approach were scanned manually to remove false positives. To provide the best possible estimate of the number of peerreviewed documents that have been influenced by the ESAS paper and that contributed to the dissemination of the knowledge it contains, other searches for peerreviewed documents that cited (CRSs) or made an uncited reference (keyword searches) to the index ESAS paper were performed in complementary databases (i.e. WoS, Medline, Google Scholar). In Medline, only the keyword searches were performed, as a CRS was not possible in this database. In Google Scholar, only the CRS was performed because the keyword searches returned many false positives.

Grey literature search strategy
The first step of the search strategy involving grey literature included collating a relevant bibliography of grey literature by systematically analysing Eduardo Bruera's curriculum vitae and research centres' publication lists. Cited references were then located using cited author, cited work and cited year. A starting point was to perform CRS queries using the first author's name that appeared on relevant grey literature documents and to set cited years within a relevant range. From there, a search for documents citing the original ESAS paper was performed in Google and Google Scholar using 'Eduardo Bruera', 'Edmonton Symptom Assessment Scale', 'Edmonton Symptom Assessment System' and 'ESAS' as keywords, and the frame of 1991–2006. The search included reports, working papers, conference proceedings, encyclopaedia entries, contributions to handbooks, textbooks and other types of grey literature. Multiple additional sources within the grey literature were searched, including the National Guideline Clearinghouse, Proquest Dissertations and Theses database, New York Academy of Medicine Library website (http://www. nyam.org/library/pages/grey_literature_report) and others (details available upon request). The results were checked, one by one, against the selected grey literature documents' title listed in the initial grey literature bibliography. Care was taken to consider all variants of the title references and to select all those that appeared to be unique, relevant matches.

Data management
All documents retrieved from Scopus were classified by one of the authors according to one of six reference reasons: developing/assessing, using, reviewing, citing in support of a statement, single mention in the general context and unknown. See Table 1 for definitions of each. This classification describes the objective of the citing authors who referenced the index ESAS paper in their work. Since this process is in part subjective, the classification was validated independently by a second author who reclassified a sample of 30 papers. Based on this validation, the classification was estimated to be precise at about 85%. Most disagreement between authors involved citing in

support of a statement or developing/assessing. Consequently, a thorough examination of citation outputs was carried out. This allowed us to not only assess the impact of the ESAS paper based on citation counts, but also to describe the nature of its impact on the scientific community by looking at the content of the citing papers themselves.

Table 1. Reasons for citing the index ESAS paper

Reference reason	Description
Developing/assessing	When a document referencing the ESAS paper describes work to develop or assess the ESAS itself or any comparable assessment tool. In such cases, the knowledge disclosed in the original ESAS paper contributes to the improvement of tools for the assessment of patients in palliative care.
Using	When a document referencing the ESAS paper describes work in which the ESAS was used to assess patients in palliative care units for purposes other than developing and/or assessing comparable tools. In such cases, the knowledge disclosed in the original ESAS paper was directly applied.
Reviewing	When the document referencing the ESAS paper reviews assessment tools for patients in palliative care.
Citing in support of a statement	When a reference to the ESAS paper is used to support a statement and that the document is not developing and/or assessing the ESAS or any comparable tool.
Single mention in the general context	When a document references the ESAS paper to contextualize the study being described (the reference will usually appear in the introduction).
Unknown	The full text of the document could not be obtained and the document could not be classified based on the title and abstract alone.

Bibliometric indicators
To produce bibliometric data to analyse the diffusion of knowledge disclosed in the ESAS paper, all document types (articles, reviews, conference papers and editorials) were retained. However, consistent with the usual approach in bibliometrics, editorials were not included in the citation analysis.[10] Data were analysed for a range of bibliometric indicators using Microsoft SQL ServerTM 2000 SQL Query Analyzer, a graphical tool (http://msdn.microsoft.com/en-us/library/aa216945 (SQL.80).aspx). Indicators that figured prominently in our results were the number of documents citing or making an uncited reference to the index ESAS paper, calculated by year, by reference reason, by country, by field and subfield of science (based on classification of journals used by the US National Science Foundation) and by reference source (i.e. reference made by authors of the index ESAS paper [self-referencing] or by other authors [not self-referencing]).

Citation network analysis
To identify the main development paths within the citation domain of the index ESAS paper, an analysis of the ESAS citation network was performed using Pajek 1.02, a software program for large network analyses.[11]

The citation domain of the ESAS paper is composed of documents that cite or make an uncited reference to the ESAS paper, as well as documents citing it indirectly via one or more go-betweens (e.g. if B cites A and C cites B, C is said to have cited A with one go-between). The impact of knowledge disclosed within a scientific paper often extends beyond those who cited it directly, particularly when the research is of interest to different disciplines. However, as one moves away

from the ESAS paper (i.e. many go-betweens in the network), the citation network rapidly grows to an extent where it becomes impossible to analyse the flow of knowledge. In addition, as the distance from the ESAS paper increases, the likeliness that the citing work can inform the diffusion of knowledge disclosed in the ESAS paper decreases (i.e. it is as if at a certain distance there was an inflectional point at which the relevance to the ESAS paper starts decreasing). As such, a cutoff point must be chosen to restrict the domain to a manageable size for sound interpretation and visualization of the diffusion of knowledge within the vicinity of the ESAS paper. The choice of this cutoff is partly subjective, involving trial and error. The final dataset that was retained for the network analysis included all documents citing the index ESAS article at a maximum distance of two (i.e. documents that directly cited the ESAS or documents that cited another document citing the ESAS). At a distance of three, the network was already too large for proper analysis. Alternative cutoffs could have involved selecting papers that were above a distance of two but that co-cited at least two articles at a distance of one.

A search path count method was used to define the network's main path (i.e. main developmental stream of literature in the restricted domain of the ESAS paper).[12] Once the main path was identified, a sub-network was extracted to allow for visual inspection by removing arcs (i.e. paths connecting cited documents to citing documents) whose citation weights were inferior to a threshold set to the lowest weight found on the main path (0.0062).

Results
Overall, we identified 311 unique documents that directly cited or made an uncited reference to the index ESAS paper between 1991 and 2006 using all four databases (i.e. Scopus, WoS, Medline and Google Scholar). Because Google Scholar is not a well-established database of peer-reviewed literature (it includes a substantial amount of grey literature not well suited to citation analysis), a more in-depth analysis of overlap was carried out on the three other databases. In Scopus, WoS and Medline, 265 unique documents were identified. These documents were mainly peer-reviewed articles (74%) and reviews (24%), while the remaining documents were conference papers or editorials (2%). There was significant overlap between Scopus (222 manuscripts), WoS (203) and Medline (58) databases (Figure 1). Searching the WoS and Medline only added 43 documents to those found in Scopus, which represents about 20% of Scopus' coverage of documents citing or making an uncited reference to the original ESAS paper for the 1991–2006 period. Thus, Scopus provided a comprehensive coverage of peer-reviewed literature citing or making an uncited reference to the original ESAS paper. Therefore, subsequent bibliometric indicators were only produced using Scopus (see the following sections below: *Analysis of bibliometric indicators* and *The citation network and its attributes*).

Grey literature searches identified 39 hits – 22 presentations in nursing, medicine and other venues, with the remainder being reviews, reports and theses. Thirty-three hits were works by researchers other than the index ESAS authors. As of 2007, Eduardo Bruera's curriculum vitae listed 686 presentations around the world since publishing the ESAS.
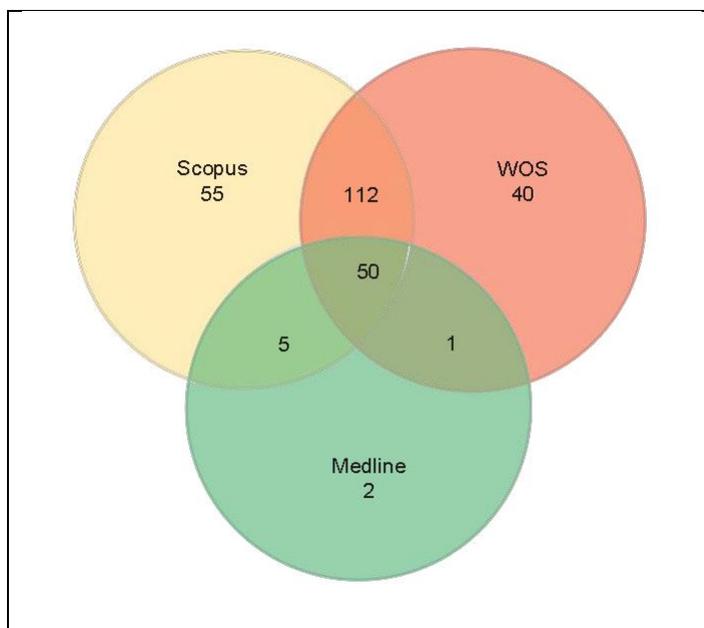
Figure 1. Overlap between Scopus, the WoS, and Medline with respect to the documents citing or making an uncited reference to the original ESAS paper, 1991—1996.
Note: The Venn diagram is not to scale
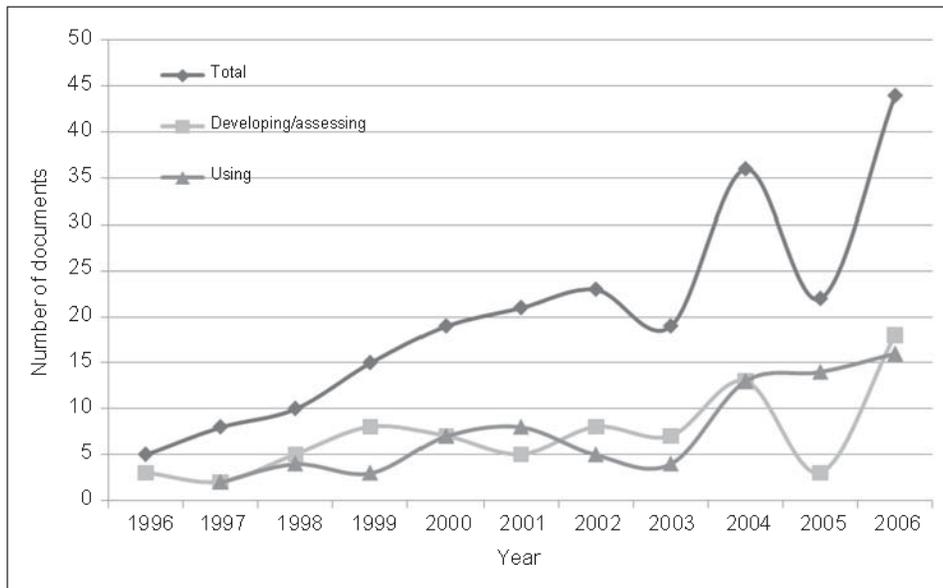Source: Compiled by Science-Metrix

Analysis of bibliometric indicators
Using the Scopus database (222 manuscripts), Figure 2 shows the number of publications citing the tool steadily increased each year since the index publication, with 80% of citations not made by authors of the ESAS. While the number of references made to the index ESAS paper continues to increase, the number of references to the index ESAS paper by its authors remains fairly stable.

Most authors who cited or made an uncited reference to the index ESAS paper did so because they were developing/assessing the ESAS itself or another comparable assessment tool (36% of citations) or because they used the ESAS to assess patients in palliative care units for purposes other than developing and/or assessing comparable tools (34%) (Figure 3).
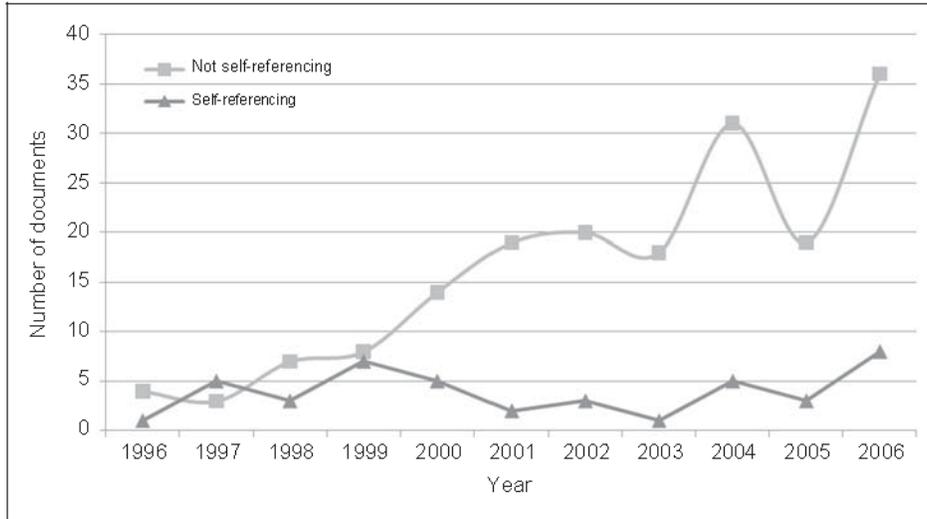
Figure 2. Number of documents citing or making and uncited reference to the index ESAS paper with and without self-referencing, 1991–2006.
Source: Compiled by Science-Metrix

Figure 3. Number of documents citing or making and uncited reference to the index ESAS paper by 'reference reason,' 1991–2006.
Source: Compiled by Science-Metrix

The published outputs displayed a wide geographical range in knowledge dissemination from the index ESAS paper. The ESAS has mostly been referenced by authors from North America (who contributed to 59% of documents) and Europe (who contributed to 34% of documents); However, the geographical range of dissemination increased steadily over time, from three countries in 1996 to 25 in 2006. Increasing collaboration between authors in different countries as expanded lobal coverage of the ESS. Countries of authors include the United States, Canada, Spain, Germany,

China, Czech Republic, Israel Malaysia, Republic of Korea and Turkey (see Table 2 for the full range of countries of author origin).

Table 2. Number of documents citing or making and uncited reference to the index ESAS paper by country, 1991–2006.

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total
United States	1		3	3	10	4	9	7	15	6	17	75
Canada	3	6	4	9	7	5	4	6	5	4	12	65
United Kingdom		1	2	4		3	1		3	1	1	16
Switzerland		1				1	4	3	2		2	13
Norway						2	1	1		1	4	9
Spain			1		1	1	1		4		1	9
Australia			1	1		1		1	1	1	1	7
Denmark						2	2		1	1	1	7
Belgium					1	1	1		1	1	1	6
Sweden						2	1	2		1		6
Italy	1	1								2	1	5
Netherlands								1		2	1	4
France					1			2				3
Germany					2			1				3
China						1	1					2
Japan								1	1			2
Argentina									1			1
Czech Republic								1				1
Greece									1			1
Ireland									1			1
Israel											1	1
Malaysia										1		1
Poland											1	1
Republic of Korea											1	1
Turkey										1		1
Total	**5**	**8**	**10**	**15**	**19**	**21**	**23**	**19**	**36**	**22**	**44**	**222**

Source: Compiled by Science-Metrix using Scopus data.

Few papers explicitly describe translating the ESAS into other languages.[13–16] Several publications suggested that the ESAS was translated into other languages.[17–21] The Regional Palliative Care Program in Edmonton, Alberta had been developing translations of the ESAS,[13] and the grey literature search identified a Cancer care Ontario website where the ESAS can be downloaded in English, French-Canadian and 28 other languages (http://www.cancercare.on.ca/cms/one.aspx?objectId=58189&contextId=1377).

Table 3 shows the fields and subfields of science in which papers citing or making an uncited reference to the ESAS paper have been published and Figures 4 and 5 show how they have moved beyond the index scope of cancer patients. The majority of documents are cited in clinical medical areas, such as cancer, neurology and neurosurgery, as well as general and internal medicine. Citations of the ESAS, which is a bedside clinical tool, are also found in pharmacology and

pharmacy. Further, many citations were found in the field of Health Sciences, including health policy and services, nursing and public health.

Table 3. Number of documents citing or making and uncited reference to the index ESAS paper by country, 1991–2006.

| Field/subfield	Number of documents	Cumulative percentage
Clinical medicine	147	66.2
Cancer	62	27.9
Neurology & neurosurgery	37	16.7
General & internal medicine	31	14.0
Surgery	5	2.3
Anaesthesiology	3	1.4
Pharmacology & pharmacy	2	0.9
Psychiatry	2	0.9
Urology & nephrology	2	0.9
Endocrinology	1	0.5
Gastroenterology	1	0.5
Haematology	1	0.5
Health sciences	34	15.3
Health policy & services	1	5.9
Nursing	3	1.4
Public health	3	1.4
Geriatrics & gerontology	1	0.5
Unknown	14	6.3
Psychology & psychiatry total	2	0.9
Unknown	39	17.6
Total	222	100%

Source: Compiled by Science-Metrix using Scopus data.
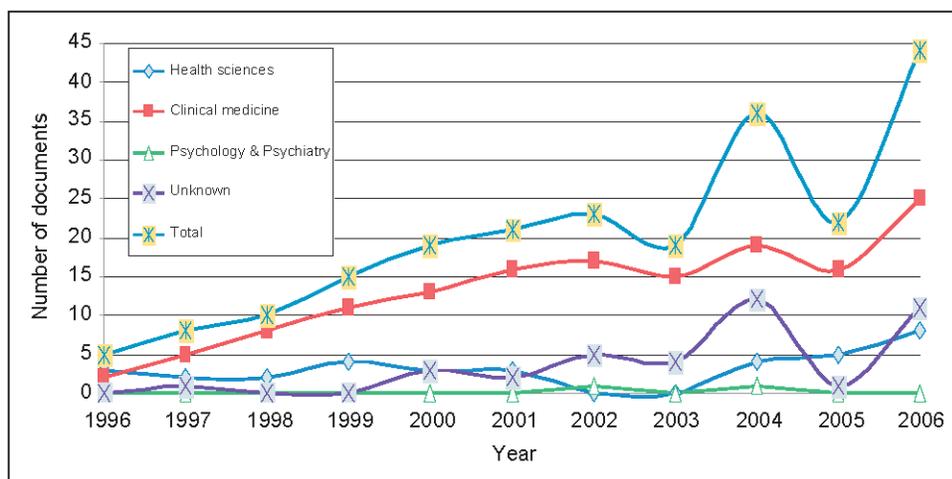
Figure 4. Number of documents citing or making an uncited reference to the index ESAS paper by field of science*, 1991–2006.
*Health Sciences field includes: Health policy and services, nursing, public health, and geriatrics and gerontology.
Clinical medicine field includes: cancer, neurology and neurosurgery, general and internal medicine, surgery, anaesthesiology, pharmacology and pharmacy, psychiatry, urology and nephrology, endocrinology, gastroenterology, and haematology.
Source: Compiled by Science-Metrix from Scopus data.
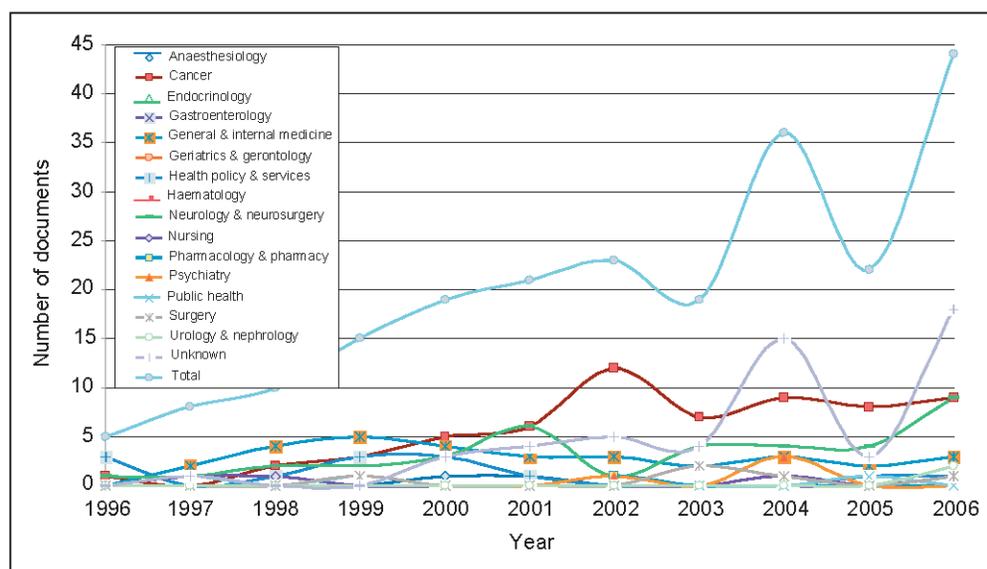
Figure 5. Number of documents citing or making an uncited reference to the index ESAS paper by subfield of science, 1991–2006.
Source: Compiled by Science-Metrix from Scopus data.

The citation network and its attributes
Citation network analysis of the index ESAS paper using data derived from Scopus identified nearly 900,000 documents. This includes documents citing or making an uncited reference to the index ESAS paper, as well as documents citing the ESAS paper indirectly by one or more go-betweens. The most distant document was separated from the index ESAS paper by 37 go-betweens. Since the goal was to identify key research developments in the vicinity of the ESAS, a restricted

domain was analysed that included documents at a maximum distance of two (i.e. one go-between) from the source document. This restricted domain includes 222 documents at a distance of one, and 1981 documents at a distance of two, for a total of 2204 documents, including the ESAS paper itself.

A sub-network was extracted from the main ESAS network path to allow for visual inspection, as described in the Methods section. This sub-network constitutes the main path components of the ESAS network, and contains a total of 85 documents (Figure 6). The ESAS paper is the starting vertex on the main path, as it is the sole source document of the network. From there, the main path component has two branches in which some arcs have high citation weights: the main path itself (right branch in Figure 6; circles with borders) and a branch dominated by Charles Loprinzi's articles (left branch in Figure 6; circle with black border).

Analysis of the main path (i.e. highlighted papers on the right branch) reveals that seven years after the initial appearance of the ESAS in the peer-reviewed literature, it made the jump from palliative care specialty journals to a very high impact, international, general medical journal.[22] This paper reviewed the ESAS paper and comparable tools and it appears to have played a key role in the subsequent uptake of the ESAS, since there quickly followed a series of additional publications that cited it and that used or developed/ assessed the ESAS. Some of these articles were again published in very high impact medical journals (Lancet, Journal of the American Medical Association, Journal of Clinical Oncology). The citation network analysis revealed that these additional publications were of great impact.

From this analysis, reviews appear to be very effective tools to disseminate knowledge and promote uptake, while publication in high impact journals likely accelerated the subsequent uptake of the tool in the peer-reviewed literature, and possibly in the grey literature. As the highest impact journals generally have a more restrictive inclusion policy (i.e. as they are highly cited, more researchers choose to compete for space in these journals, and therefore proportionately fewer papers are selected), these journals are associated with prestige. In turn, they are read more frequently by the scientific community, accelerating the uptake of the knowledge that is published. They also have a broader readership, increasing the likelihood of uptake of specific knowledge in multiple fields.

In the right branch in Figure 6, four of 13 papers cited the ESAS paper directly.[22–25] The first two papers were classified as developing/assessing the ESAS or any comparable tool and the last was classified as using the ESAS. Thus, key papers identified in the development of tools to assess palliative care patients directly dealt with developing/assessing the ESAS or comparable tools.

Within the left branch in Figure 6, the main article that directly cited the index ESAS paper was authored by Loprinzi et al.[26] This article did not develop or assess the ESAS itself or any comparable assessment tool, nor did it use the ESAS to assess patients in palliative care units; rather, in the analysis conducted for the present report, this article was classified as citing the index ESAS paper in support of a statement. Thus, developments along this branch in the network are probably not tightly linked to the ESAS or any comparable tool. The reason behind strong citation weights along this branch is that Loprinzi et al.'s[26] paper was highly cited (303 citations).

Analysis of factors that promoted the uptake of the ESAS

A review of bibliometric data from the peer-reviewed and grey literature indicates a rapid and diffuse uptake of the ESAS, evidenced by its apparent use in diverse specific clinical settings, professional groups and countries. Through evaluation of bibliometric indicators, the ESAS citation network and descriptions of the tool in cited papers, we suggest that six major factors have been associated with successful launch and uptake of the ESAS in academic and clinical communities:

- publication in high impact, international journals;
- literature reviews on the ESAS and comparable tools;
- appeal of the tool to multiple professional groups, including medical, nursing, pharmacy, psychology, health administration and others;
- widespread discussion by multiple professional groups as evidenced by grey literature;
- widespread belief that use of the tool is an innovation supporting best practice;
- translation into several languages and early availability of the ESAS to users through those publications.

Note that some of these six fields relate to the attributes of the tool itself and some relate to the dissemination processes for palliative care research generally.
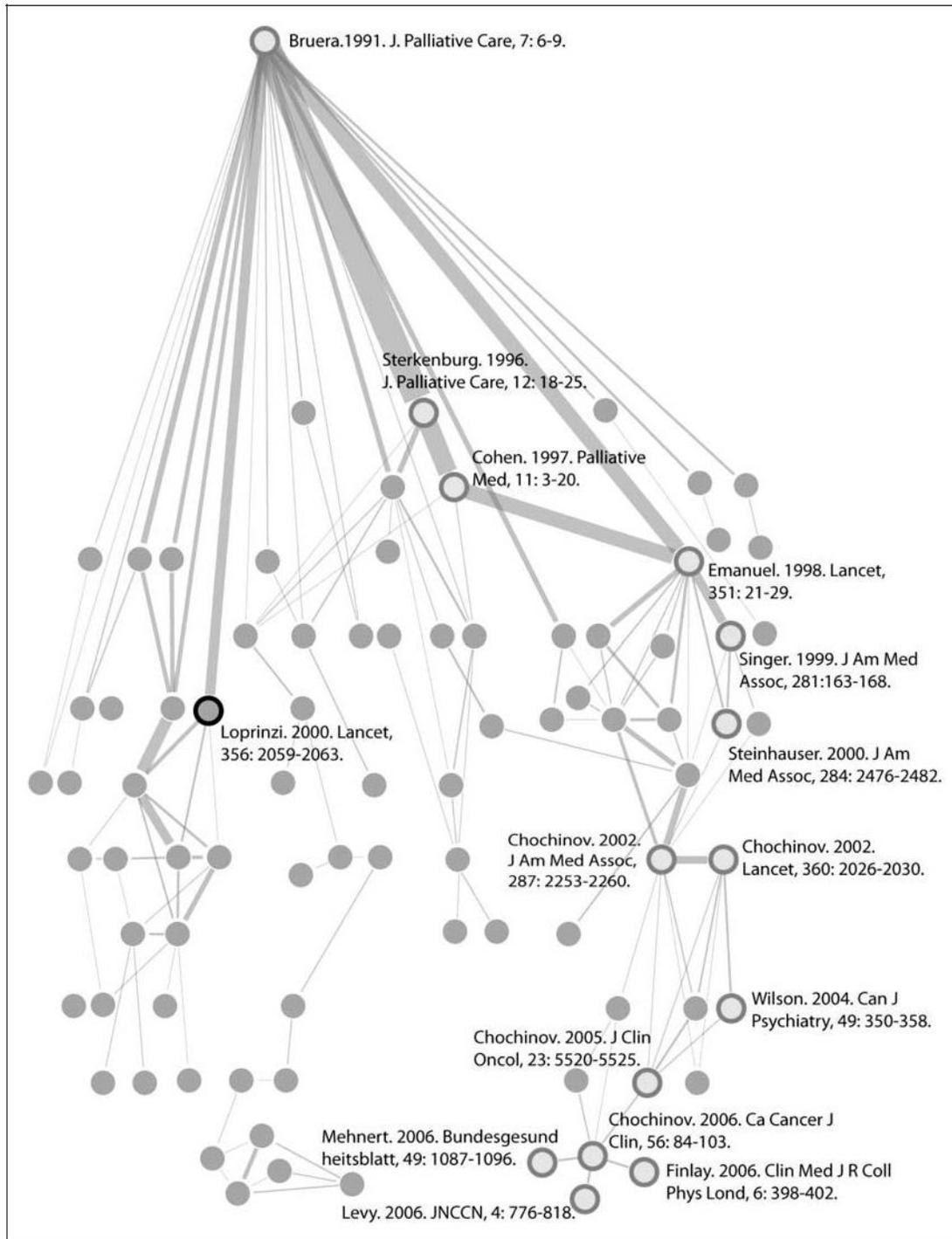
Figure 6. Mapping the flow of knowledge of ESAS in published literature.
The circles with thick, shaded borders within the right branch of the network represent papers with the highest citation weight along the citation path. These key papers identify the main path of the literature citing the ESAS within the sub-network.

Discussion

The ESAS has had an enormous impact on the clinical care of palliative patients around the world. Analysis of its uptake over time reveals several factors that have supported its broad and rapid adoption by the global palliative care community.

Since the ESAS covers a wide range of measures in its assessments, from physical to psychological, it is not surprising to see a wide range of communities who have used and further developed the ESAS. This broad appeal has likely contributed substantially to its dissemination. A review of fields of publications over time demonstrates that most commonly, publications on the ESAS were in clinical medicine journals and much less in psychology, psychiatry or other health science journals. Within clinical sciences, general and internal medicine journals were an important part of the early dissemination of the ESAS; specialty cancer publications were more important later on. Numerically, nursing, geriatrics and gerontology were much less important in the dissemination of the ESAS, a surprising observation given the pivotal role that nursing plays in the use of the ESAS tool and its relevance in geriatric populations.

These patterns indicate that major innovations in palliative care tend to be picked up by general and internal medicine journals at an early stage, reflecting the role of these journals as channels used by early adopters in the global palliative care community. Later studies appearing in cancer journals are consistent with a more mature field of study being promoted within a specialty-level venue of discourse. If generalizable to the future learning patterns of the global palliative care community, these results suggest researchers should submit what they think to be ground-breaking innovations to general and internal medicine journals, and should recognize that at a later stage of maturity of the area of study they may wish to target specialty journals for publication.

Study findings were consistent with observations that the primary author of the index ESAS paper is an internationally recognized palliative care expert. His multi-language fluency promoted it in various cultures, and thereby increased effective dissemination of the ESAS.

Figure 3 demonstrates a curious observation: *research on the tool* increased over time, concurrent with parallel increases in *publications describing the use of the ESAS* in a range of practice settings. While there may be other explanations, we interpret these patterns as reflecting a kinaesthetic learning style within the palliative care community, that is, learning by doing. A kinaesthetic learning style is different from classical models of learning, whereby research is published, followed at a later time by published experience in the application of research. We posit that the palliative care community is characterized by kinaesthetic learners. These early adopters use new knowledge and undertake research on it, concurrently. This predicts that uptake of advances in palliative care will be faster and broader if innovations hold two characteristics: the innovation is immediately ready to apply clinically; and there is ample opportunity to undertake additional research in the area.

Some technical aspects of the bibliometric review merit additional comment. Few documents referenced the index ESAS paper without citing it, indicating that the index assessment tool itself has made an important impact. In addition, the index ESAS paper has not yet reached its citation peak and therefore its rate of citation in the peer-reviewed literature can be predicted to increase in the future. This is a trend often observed for papers introducing a new method or tool; while most health sciences papers will reach their citation peak two to three years after publication, after which

citations undergo a slow but steady decrease, papers describing a methodological breakthrough often reach their citation peak many years after publication.[27]

Further, the majority of citations were not made by the authors of the ESAS, providing additional evidence of robust dissemination within the broader scientific community. While the number of references made to the index ESAS paper continues to increase each year, references from its authors remain fairly stable. Thus, increases in ESAS citations arise from researchers other than the authors of the index paper.

The bibliometric method has some inherent weaknesses. Note that some papers outside the main path of the citation network can be underestimated in their impact, particularly those that have stronger citation weights than papers in the main path. In the current study, most recently published papers outside the main path had little or no opportunity to be cited. Further, not all articles dealing with tool development to assess palliative care patients will fall within the restricted domain of the ESAS paper. Therefore, the current approach does not provide an exhaustive listing of mainstream articles in this area. Because a citation network cannot be captured in its entirety (it is virtually endless), specific bounds must be set to answer specific questions and the network should not be used to infer beyond the scope of these questions. In addition, citations from articles published in languages other than English are likely to be underestimated to various degrees (Latin languages will be the least affected). Although Scopus covers journals in languages other than English (such as Chinese), it often does not contain their cited references. We have attempted to mitigate this by assessing and coding the reason each included paper had for referencing the ESAS. Bibliometrics also do not measure actual clinical use of research knowledge in practice.

Conclusions

This review of bibliometric data has documented rapid and widespread uptake of the ESAS tool through a wide range of communication channels, over time, providing evidence of its apparent use within diverse clinical settings, professional groups and countries. This study suggests the community of palliative care learners is made up of a highly diverse group of professionals, languages, countries, academics, bedside clinicians and administrators. In addition, the palliative care community is comprised of kinaesthetic learners: the community applies innovations within the clinical realm as it embarks on additional research on those innovations.

If lessons learned from the world-wide dissemination of the ESAS and inferences about attributes of this community of learners are generalizable to future advances in palliative care, widespread uptake of innovation within the global palliative care community can be supported through several specific approaches:

- targeting publication in high impact, international journals;
- the publishing of reviews on the targeted subject;
- explicitly focusing on applicability of the innovation to best practice;
- encouraging additional research to confirm and expand on early studies;
- consciously targeting key professional groups and organizations in order to promote discussion beyond the peer-reviewed literature; and
- early translation and promotion within multiple languages.

In short, uptake of innovations in palliative care can be best promoted by pragmatic publications appealing to diverse audiences.

Conflict of interest statement
None declared.

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