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Finding Knowledge Translation Articles in CINAHL

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Abstract

Background: The process of moving research into practice has a number of names including knowledge translation (KT). Researchers and decision makers need to be able to readily access the literature on KT for the field to grow and to evaluate the existing evidence. Methods: To develop and validate search filters for finding KT articles in the database Cumulative Index to Nursing and Allied Health (CINAHL). A gold standard database was constructed by hand searching and classifying articles from 12 journals as KT Content, KT Applications and KT Theory. Main outcome measures: Sensitivity, specificity, precision, and accuracy of the search filters.
Results: Optimized search filters had fairly low sensitivity and specificity for KT Content (58.4% and 64.9% respectively), while sensitivity and specificity increased for retrieving KT Application (67.5% and 70.2%) and KT Theory articles (70.4% and 77.8%). Conclusion: Search filter performance was suboptimal marking the broad base of disciplines and vocabularies used by KT researchers. Such diversity makes retrieval of KT studies in CINAHL difficult.

Keywords:

Diffusion of innovation, Information dissemination, Evidence-Based Medicine

Introduction

Getting research into practice has become a focus for medical researchers and decision makers globally [1]. How to accomplish this is less clear. The field of research studying how best to implement new research findings is fairly new, with its origins in Roger's diffusions of innovations work in the field of agriculture[2]. Many disciplines are actively investigating theories, methods and frameworks to facilitate the movement of research into practice[3,4], each discipline with its own vocabulary and methods [5].

The process of getting research into practice in health care is often termed knowledge translation (KT). This is defined by the Canadian Institutes of Health Research (CIHR) as "*the exchange, synthesis and ethically-sound application of knowledge - within a complex system of interactions among researchers and users - to accelerate the capture of the benefits of research for Canadians through improved health, more effective services and products, and a strengthened health care system*" [6]. Terms used to refer to moving research into practice by other funding agencies include knowledge transfer, knowledge exchange, research utilization, uptake and dissemination [7].

Developing search filters for large databases can help researchers and decision makers optimize search retrieval, capturing articles of interest (true positives) and reducing the number that are not of interest (false-positives). Such search filters have been developed for methodological aspects of studies [8, 9], and also for content [10, 11].

We approached the KT literature as having 2 natural sub groups of articles, those related to interventions designed to change behaviors (KT Applications) and those related to the theory and understanding of KT (KT Theory). In this study, we sought to develop and validate search filters to retrieve articles with content related to KT in general as well as KT Applications and KT Theory. A large body of KT literature exists within the field of nursing so in this instance we focused our search strategy development for use in the CINAHL database via EBSCOhost.

Materials and Methods

To develop and validate the search filters, we used a diagnostic testing assessment framework. We created a gold standard database by hand searching the literature and classifying content as of interest to KT (KT articles) or not of interest to KT (non-KT articles). Search terms were tested using the database and the sensitivity, specificity, precision and accuracy with which the terms retrieved the target articles (KT articles) were calculated. Sensitivity is the proportion of target articles retrieved, while specificity is the proportion of non-target articles that were not retrieved. Precision measures the proportion of retrieved articles that were on target, and accuracy measures the proportion of articles that were classified correctly.

Table 1 –Abridged inclusion criteria for articles with KT Content, KT Applications and KT Theory

KT Content includes the more specific areas of • Educational interventions • Peer-to-peer knowledge brokering • Finding information • Articles outlining barriers to providing care by clinicians • Application of Evidence-Based Medicine/practice • Quality of care and quality improvement strategies • Production of systematic reviews, guidelines, and other knowledge syntheses • Implementation of knowledge syntheses, guidelines or research findings • System modifications based on evidence • Setting policy using evidence • etc
KT Application: articles that are identified as KT and then describe a study or project in a specific setting or settings to implement a KT strategy eg. strategies that increase implementation, or a project to improve uptake of a specific intervention or knowledge area such as vaccinations, screening procedures, smoking cessation approaches, etc.
KT Theory: articles that describe or develop the general understanding of the KT process or theory. • Theories, models or frameworks of KT • Processes of KT • KT across disciplines, vocabulary and scope • Other theories contributing to our understanding of KT

Our gold standard database was constructed by careful reading of all articles published in 2006 in 12 journal titles. Our required sample size of on-target articles (KT articles) was between 110 and 150 [12] . To get a representative sample of the health literature, journals expected to have a high yield and a low yield of KT articles were included [12]. The method of journal selection is reported elsewhere [13].

Using a clear reading guide (developed with input from all authors who have KT expertise -NW, RBH, DC, MD, DAD, SES) articles were tagged as having KT content; those assessed as having KT content were further tagged as relating to a KT Application or KT Theory if applicable (abridged inclusion criteria -see Table 1). The reading guide was based on the full CIHR definition of KT [6] (the reading guide is available from the authors). Articles were read in duplicate by KAM and CL. Disagreements were adjudicated with consensus.

Table 2 – Number of articles classified as KT Content [KT Content- not instruments in square brackets], KT Applications (KTA) and KT Theory (KTT) in the 12 journals hand searched in 2006 (all 12 were indexed in CINAHL)

Journal	**# Read**	**KT Content**	**KTA**	**KTT**
High KT-yield journals				
BMJ	518	150[82]	31	23
Annals of Internal Medicine	260	109[39]	22	7
JAMA	310	87[28]	18	4
Social Science and Medicine	530	87[86]	47	57
Journal of Advanced Nursing	265	47[47]	35	27
Health Affairs	199	39[39]	15	11
Low KT-yield journals				
Journal of the Medical Library Association	59	16[16]	8	2
Addiction	168	13[13]	9	7
International Journal of Nursing Practice	48	9[9]	5	5
Journal of Occupational and Environmental Medicine	148	8[7]	4	1
Nursing Research	49	7[7]	6	7
Nursing Inquiry	31	1[1]	0	1
Totals	**2585**	**573[374]**	**200**	**152**

A posteriori we determined that a number of articles that were classified as KT Content only (not further classified at KT Application or KT Theory) presented information (ie content) for patient or clinician education. These articles included *JAMA*'s "Patient Page", *Annals of Internal Medicine's* "Summaries for Patients" and *BMJ*'s "ABC of [disease]" These tagged articles do not describe a KT intervention or theory, rather they are essentially a KT instrument for clinicians that can be printed and given to patients or articles educating clinicians on specific topics. As such, they represented a further subset of KT Content –articles to be used as KT instruments. We therefore created a further subset of articles for 'KT Content-not instruments' in an effort to improve the performance of search terms retrieving general KT Content articles. See Table 2 for the classification of articles.

Using KT published terms, Medline and CINAHL indexing terms, frequent terms in tagged articles (PubReminer (http://bioinfo.amc.uva.nl/human-genetics/pubreminer/) and terms suggested by KT researchers, we compiled a list of 3423 index terms and textwords to test their retrieval characteristics. The terms were submitted to CINAHL via EBSCOhost. Multiple spellings and endings were applied. Terms were tested as keywords and text words (TX). Keyword searches require no field codes and search title, abstract and subject headings. Textword searches are coded with TX and search all indexed fields and full-text. Index terms were searched using the MH field code. The retrieval characteristics were calculated for each search term. All calculations were done by an automated online system developed at McMaster University. The system allows for the performance of single terms to be viewed as well as 'OR'ed combinations of terms that are computer generated. The system also allows the researcher to combine single terms using the Boolean 'OR'. Terms are 'OR'ed to maximize sensitivity and specificity.

The system generated 'OR'ed combinations of all terms and we selected the highest performing combinations to generate the 'best' search filter for detecting articles that were classified as (a) KT Content, (b) KT Content – not instruments, (c) KT Application and (d) KT Theory, while trying to keep the number of terms to a minimum. We report the best sensitivity filter keeping specificity ≥50%, best specificity filter keeping sensitivity ≥ 50% and best filter optimizing sensitivity and specificity using four term combinations (abs[sensitivity-specificity]<1%).

Our sample size was adequate for the KT Content and 'KT Content-not instruments' searches; for these we randomly divided the database into a 60:40 development/validation set of 1551 and 1034 articles respectively. Search strategies for KT Content, both with and without instruments, were developed in the development set and tested in the validation set. The proportions for sensitivity, specificity, precision and accuracy were compared between the two datasets as independent proportions using Arcus QuickStat.

Results

Our sample included 2585 articles, 573 tagged as KT Content, 374 KT Content-not instruments, 200 KT Applications and 152 KT Theory. Journals expected to have a higher yield of KT articles had a mean of 25.4% KT Content (95%CI 15.3 to 35.6) while low yielding journals had a mean of 12.8% (95%CI 3.2 to 22.3). The two groups of journals however were not statistically different in the proportions of articles tagged as KT Content, KT-not instruments, KT Application or KT Theory.

Table 3 – Combinations of Four Terms with the Best Sensitivity (keeping Specificity ≥50%), Best Specificity (keeping Sensitivity ≥50%), and Best Optimization of Sensitivity and Specificity (based on abs[sensitivity-specificity]<1%) for Detecting KT Content in CINAHL. Articles were assessed as all KT Content and then as KT Content with instruments removed. Values for the development data, the validation data, their absolute difference are given.

Search Strategy for KT content (EBSCOhost CINAHL)	Sensitivity (%) Development Validation Diff (95% CI)[a]	Specificity (%) Development Validation Diff (95% CI)[a]	Precision (%) Development Validation Diff (95% CI)[a]	Accuracy (%) Development Validation Diff (95% CI)[a]
KT Content including instruments				
Best Sensitivity – therapeutic* OR evaluation OR patient* OR polic*	62.9 59.1 -3.8(-4.4 to 12.0)	55.8 56.4 0.63(-5.0 to 3.8)	29.5 26.8 -2.7(-2.4 to 7.8)	57.4 57.0 -0.42(-3.5 to 4.3)
Best Specificity- patient education OR decision making OR therapeutic OR patient*	50.4 43.6 -6.8(-1.6 to 15.1)	70.0 68.2 -1.9(-2.2 to 6.0)	33.1 27.0 -6.1(-0.08 to 1.2)	65.6 63.0 -2.6(-1.1 to 6.4)
Best Optimization of Sensitivity and Specificity- clinical trial* OR therapeutic* OR patient* OR utilization	58.4 50.0 -8.4(-0.02 to 1.7)	64.9 64.5 -0.36(-3.9 to 4.6)	32.9 27.6 -5.3(-0.52 to 10.9)	63.4 61.4 -2.0(-1.8 to 5.8)
KT Content excluding instruments				
Best Sensitivity – evaluation OR evidence based practice OR health service* OR patient*	75.2 68.8 -6.5(-2.8 to 1.6)	50.6 52.9 2.4(-6.6 to 1.9)	20.9 19.1 -1.8(-2.6 to 6.1)	54.2 55.1 0.90(-4.8 to 3.0)
Best Specificity –evaluation OR evidence based practice (TX) OR health services (TX) OR health services administration (TX)	61.3 52.8 -8.5(-1.8 to 18.8)	67.8 71.2 3.4(-7.3 to 0.52)	24.9 22.9 -2.0(-3.9 to 7.7)	66.9 68.7 1.8(-5.5 to 1.9)
Best Optimization of Sensitivity and Specificity- patient OR utilization (TX) OR evaluation (TX) OR evidence based practice (TX)	71.7 59.0 -12.7(2.9 to 22.6) [b]	61.5 62.8 1.3(-5.4 to 2.9)	24.5 20.4 -4.1(-1.1 to 9.1)	63.1 62.3 -0.77(-3.0 to 4.6)

[a] Comparing the development and validation data sets. [b]Statistically significant differences at p<.05. EBSCOhost CINAHL fields: TX=text words, searches all searchable fields in full-text and citation record; ?=wildcard; *=truncation character; no field code=default title, abstract and subject heading search.

Table 4 – Combination of Terms with the Best Sensitivity (keeping Specificity ≥50%), Best Specificity (keeping Sensitivity ≥50%), and Best Optimization of Sensitivity and Specificity (based on abs[sensitivity-specificity]<1%) for Detecting KT Application and KT Theory Content in CINAHL

Search Strategy for KT content (EBSCOhost CINAHL)	Sensitivity (%) (95% CI)	Specificity (%) (95% CI)	Precision (%) (95% CI)	Accuracy (%) (95% CI)
KT Applications				
Best Sensitivity – evaluation OR evidence based practice (TX) OR health services (TX) or patient (TX)	78.5 (72.8 to 84.2)	50.7 (48.7 to 52.7)	11.8 (10.0 to 13.5)	52.9 (51.0 to 54.8)
Best Specificity – randomized controlled trial OR pretest-posttest design OR decision making OR evaluation	50.5 (43.6 to 57.4)	80.0 (79.3 to 82.4)	18.1 (14.9 to 21.3)	78.5 (76.9 TO 80.0)
Best Optimization of Sensitivity and Specificity- physician OR utilization OR evaluation OR evidence based practice	67.5 (61.0 to 74.0)	70.2 (68.3 to 72.0)	16.0 (13.5 to 18.4)	70.0 (68.2 to 71.7)
KT Theory				
Best Sensitivity – research OR evaluation (TX) OR evidence based practice (TX) OR social work (TX)	80.3 (73.9 to 86.6)	52.0 (50.0 to 54.0)	9.5 (7.9 to 11.1)	53.7 (51.8 to 55.6)
Best Specificity- change* OR evidence-based medicine OR decision making OR knowledge	53.9 (46.0 to 61.9)	85.1 (83.7 to 86.5)	18.4 (14.8 to 22.0)	83.2 (81.8 to 84.7)
Best Optimization of Sensitivity and Specificity- theoretical OR decision making OR change* (TX) OR evidence based practice	70.4 (63.1 to 77.7)	77.8 (76.1 to 79.4)	16.5 (13.7 to 19.4)	77.3 (75.7 to 79.0)

Search Filters

No single terms were able to retrieve KT, KT Application or KT Theory articles with 50% sensitivity and 50% specificity. Multiple term filters were derived by 'OR'ing top performing single terms together to form 4-term combinations.

For KT Content articles, sensitivity of filters ranged from 50-62%, specificity from 56-70%, precision from 30-33% and accuracy from 57-66% (Table 3). Development and validation sets did not differ in search performance. When KT instruments were removed, sensitivity increased by ~10%, but the other performance measures did not change or were lower (Table 3). Development and validation sets performed similarly except for sensitivity of the optimal search.

KT Application filters peaked at 80% specificity, but with low sensitivity of 50% (Table 4). Similarly, sensitivity peaked at 78.5% but with low specificity. Overall the KT Application filters performed better than the general KT Content search. Performance of KT Theory filters were similar to KT Applications, maximizing sensitivity or specificity at the expense of the other, The optimal search performed with 70% sensitivity and 78% specificity, the best overall (Table 4).

Precision was low, which is not surprising since it is dependent on the prevalence. KT Application and KT Theory filters also had low precision. Accuracy improved for the KT subsets (Application and Theory) compared to the KT content filters.

The search terms that are included in the best performing filters tend to be fairly common and widely used (evaluation, evidence-based medicine or practice, research or patient) and not necessarily KT specific.

Discussion

Ideally a search filter will allow retrieval of a large proportion of the target articles with a minimum number of non-target articles, maximizing sensitivity while maintaining specificity. Our research group has published a number of such filters, relating to methodological aspects and content. Generally speaking, performance values of 90% sensitivity and 90% specificity are markers of effective search filters.

In the case of KT, we find that sensitivity and specificity do not reach high levels. For the filters focusing on the KT subsets, we were able to develop filters that performed slightly better than the general content area of KT.

From the search terms, we see that the content purpose of the search is often reflected in the filter search terms, for example, the term 'theoretical' in the optimal KT theory filter. KT Application filters included more methods terms like "randomized controlled trial" and "pretest-posttest design". But many of the other terms are not specific to the field of KT (research, patient, evaluation) and this likely explains the poor performance of the filters. Yet few KT related terms that we compiled were able to effectively detect KT articles. For example, research utilization, dissemination, and translational research did not contribute to effective retrieval of KT material Also, when maximizing specificity, sensitivity is compromised, at times leaving many target articles undetected.

Given the range of disciplines engaged in KT and the lack of a consistent vocabulary, the low performance of the search filters is not surprising. When moving forward it is important for those in the field of KT consider how we can improve our communication and understanding, for example, by agreeing on our use of KT terms. Perhaps then more effective search filters could be devised.

Alternatively, other approaches to data mining such as semantic web technologies could be studied in relation to KT literature search and retrieval. Use of these technologies could circumvent the call for a standardized terminology for the field.

Strengths

Our study sample of 2585 articles represents a sufficient sample to develop and validate KT search filters. Our journal titles cover a broad range of health fields from nursing to internal medicine, and library science to environmental science and business. The search filters performed similarly in the development and validation datasets suggesting that the performance of these searches can be generalized for use in the entire CINAHL database or other similar subsets.

Limitations

Classifying articles as KT is not a simple task. The development of the reading guideline went through many iterations with continuing input from all authors. We tried to be as systematic and consistent as possible, but it is possible that other researchers would classify some of the articles differently based on their own views and values for KT.

Statistical limitations include not having development and validation data sets for the KT Application and Theory categories. Also we were unable to perform cross-validation studies on the KT Content dataset.

Conclusions

Retrieval of KT literature from large databases remains a challenge. Our search filters do not have high enough sensitivity and specificity to allow a researcher to effectively retrieve KT articles of interest. They would be left with too many non-target articles to sort through and miss many target (ie KT) articles. A consensus regarding the use of KT terms would be one way to improve retrieval going forward. In addition, work with the large database producers such as CINAHL would likely show benefits from implementing new index terms related to KT and their consistent use.

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