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Relationship Between Clinical Pathway and Cost-Effectiveness Research Using Vosviewer: A Bibliometric Study

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***Abstract*—** The hospital is part of a social and health organization that provides plenary (comprehensive), curative, and disease prevention (preventive) services to the community. Hospitals must always strive to survive and thrive due to the large operational costs and accompanied by increased competition in the quality of service between hospitals. One way to be able to lower costs without eliminating patient safety figures is to implement a Clinical pathway (CP). Searching this systematic review using the Scopus Database, we use several bibliometric indicators such as titles and abstracts, citations, keywords, and others. The data obtained mostly contains biomedical and medical research. We use search words (TITLE-ABS-KEY ("clinical pathway") AND TITLE-ABS-KEY ("cost-effectiveness")) and PUBYEAR > 2010 AND (LIMIT-TO (OA, "all"). All data were taken at the same time (November 2021) to reduce bias during the study. Scopus Data Base is summarized in the form of RIS and CSV files and analyzed using VOS viewer software (version 1.6.17). In the data collected, it was found that there were 4 clusters, with the themes most often raised being pathway, cost, quality, analysis, and model. The data found a trend of increasing the number of studies from 2011 to 2021. The country that has researched the relationship between clinical pathways and cost-effectiveness the most is the United Kingdom with 78 studies. In the affiliate data, 165 affiliations were obtained with affiliations with the University of London, the University of Oxford, and the University of Sydney with the greatest number of 10 studies.

***Keywords*—** Clinical Pathway, Cost Effectiveness, Systematic Review, Quality of service.

I. INTRODUCTION

The hospital is part of a social and health organization that provides plenary (comprehensive), curative, and disease prevention (preventive) services to the community. The number of hospitals in Indonesia from 2014-2019 increased by 16.92%. In 2014 the number of hospitals was 2,406 increased to 2,813 in 2018. In its standards, whether the community's needs for referral and individual health services in an area are met can be seen from the ratio of beds to 1000 residents. The WHO standard is 1 bed for 1000 populations. The ratio of hospital beds in Indonesia is sufficient [1].

Hospitals are always striving to survive and thrive amid rising operating costs and competition for quality of service among hospitals [2].In the face of competition, hospitals can take advantage of all the resources they have and increase effectiveness and cost efficiency without reducing patient safety rates.

One way to be able to lower costs without eliminating patient safety figures is to implement a Clinical pathway (CP). A clinical pathway is very important in the management of patients in the hospital.

CP can be a liaison between discovery according to research and everyday practice based on evidence by taking important steps in patient management and can be applied to hospitals. CP focuses on reducing the variety of examinations and improving the efficiency and effectiveness of health services which can result in improved clinical outcomes and decreased length of hospitalization. Decreased length of hospitalization and improved clinical outcomes will also increase cost-effectiveness [3].

Based on several studies on the use of CP in the treatment of patients with metastases of non-small cell lung cancer (NSCLC) showed satisfactory results, by lowering the cost figure from the previous $67,050 to $52,037 after the application of CP [4]. Other studies have also shown excellent results on the treatment of asthma using CP showing a significant decrease in cost by a ratio of $2,829 before CP adoption, and $1,685 after CP application [5]. Both studies also showed no different survival rates before and after CP implementation.

Based on this background, the author conducted a literature review that aims to analyze the relationship

between clinical pathway implementation and cost-effectiveness with the expectation that data related to the clinical pathway and cost-effectiveness will further have an impact on quality control and costs incurred by hospitals.

II. METHODS

This research method uses a systematic review. The search is performed on the Scopus Database, using several bibliometric indicators such as titles and abstracts, citations, keywords, and others. The data obtained mostly contains biomedical and medical research. We use search words (TITLE-ABS-KEY ("clinical pathway") AND TITLE-ABS-KEY ("cost-effectiveness")) and PUBYEAR > 2010 AND (LIMIT-TO (OA, "all"). All the data obtained in the selection by filtering the year of publication of the study, this search. All data were taken at the same time (November 2021) to reduce bias during the study.

The raw data pulled from the Scopus Data Base is summarized in the form of RIS and CSV files and analyzed using VOS viewer software (version 1.6.17) and is done by sorting keywords and grouping keywords.

III. FINDINGS

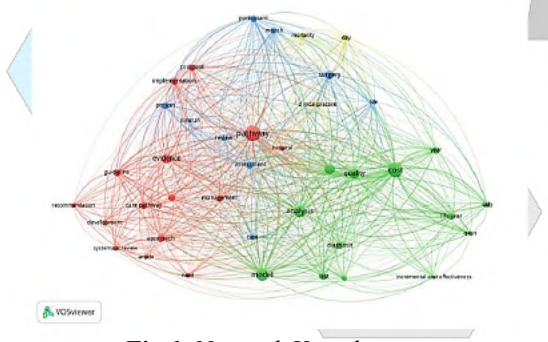

Fig.1. *Network Visualization.*

The point size represents the frequency of the keyword. The line between the two points indicates that both keywords occur in one article.

Table 1. *Cluster*

Cluster	Theme	N= 40 (100%)
Cluster 1	Care pathway, evidence, guideline, implementation, pathways, management	N= 15 (37.5%)
Cluster 2	Cost, incremental cost effectiveness ratio, analysis, cost effectiveness	N= 13 (32.5%)
Cluster 3	Assessment, clinician, participant, life, month	N= 9 (22.5%)
Cluster 4	Clinical practice, day, mortality	N= 3 (7.5%)

In the cluster above, there are 4 clusters. Cluster 1 contains the Care pathway Theme, evidence, guidelines, implementation, pathways, and management; cluster 2 contains the theme Cost, incremental cost-effectiveness ratio, analysis, and cost-effectiveness; cluster 3 contains the Theme Assessment, clinician, participant, life, month; cluster 4 contains the Theme of Clinical practice, day, and mortality.

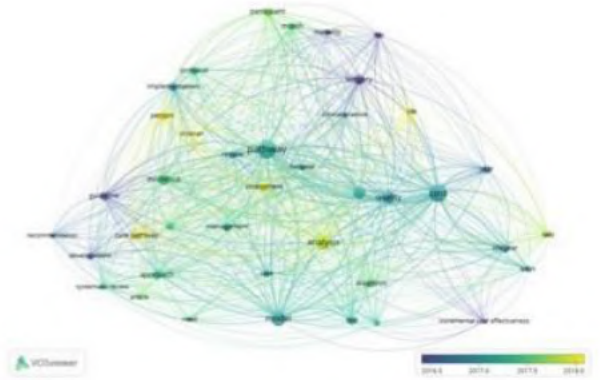

Fig.2. *Density Visualization.*

Showing a visualization of the density of the most frequently raised themes, the lighter the color indicates the more often the theme is raised

The density visualization obtained from all the research shows that several research themes are often raised such as pathway, cost, quality, analysis, and model. While some themes are rarely raised such as day, recommendation, article, need life, day, etc.

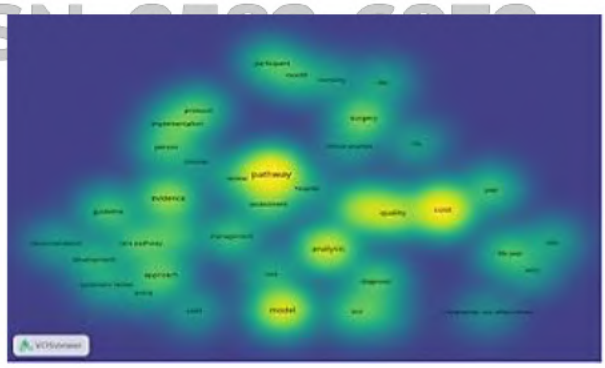

Fig.3. *Overlay Visualization.*

Visualization of the time when keywords appear. Blue keywords appear earlier than yellow keywords.

In the picture above, it was found that themes such as guidelines, development, day, surgery, mortality, and incremental cost-effectiveness showed the most frequently discussed around 2016, while themes such as pathway, cost quality, model, hospital life year, test, and implementation in 2017 and themes about care pathway,

clinician, person, life, and assessment were most frequently used in 2018.

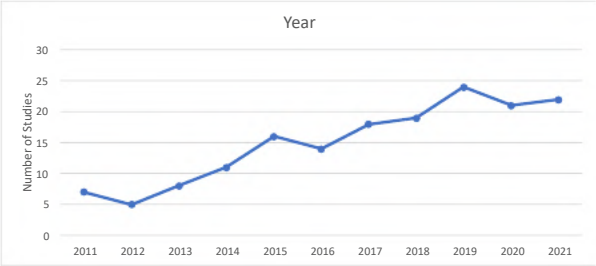

Fig.4. *The number of articles published annually.*

In the chart above, there is a trend of increasing the number of studies from year to year, in 2011 there were 7 studies issued, in 2012 5 studies were obtained, in 2013 8 studies were obtained, in 2014 11 studies were obtained, in 2015 16 studies were obtained, in 2016 14 studies were obtained, in 2017 18 studies were obtained, In 2018 19 studies were obtained, in 2019 24 studies were obtained in 2020 obtained 21 studies and in 2021 22 studies were obtained.

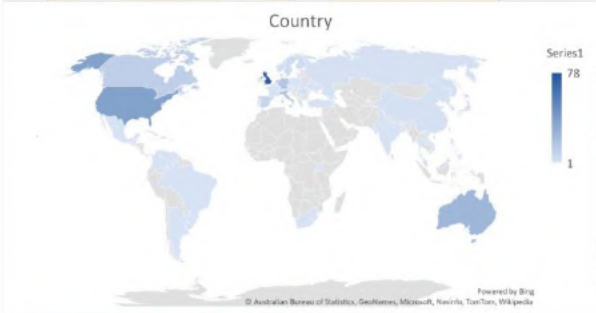

Fig.5. *Distribution of research by the country*

In the distribution map above, it was found that the countries that do the most research on the relationship between clinical pathways and cost-effectiveness were developed countries with the distribution of the United Kingdom with a total of 78 studies, followed by the United States with 37 studies, Australia with 37 studies, Italy with 18 studies, Germany with 17 studies, the Netherlands with 14 studies, Canada with 12 studies and so on.

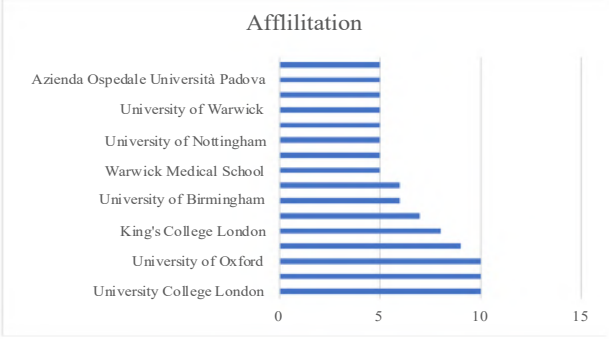

Fig.6. *Distribution of research by affiliation.*

In the affiliate data, 165 affiliates were obtained from all studies, out of the 165 affiliates there were several affiliates with the highest numbers, such as the University of London, the University of Oxford, and the University of Sydney as many as 10 studies; University of Oxford Medical Sciences Division 9 studies; King's College London as many as 8 studies; Imperial College London 7 studies; the University of Birmingham and the University of Southampton, A total of 6 studies; Warwick Medical School, The University of Sheffield, University of Nottingham, University of Aberdeen, University of Warwick, The University of Edinburgh, Azienda Ospedale Università Padova, The University of Sydney School of Medicine 5 studies each.

Fig.7. *the most frequent researchers*

In all research data, 225 authors were obtained who contributed to the entire Research and there were several authors with high publications, such as Fraser C., Lord, J., Vale, L. as many as 3 studies each; Abel, L., Asaoka, R., Azuara-Blanco, A., Banister, K., Bertram, W., Blom, A.W., Bruce, J., Burr, J.M., 2 studies each and so on.

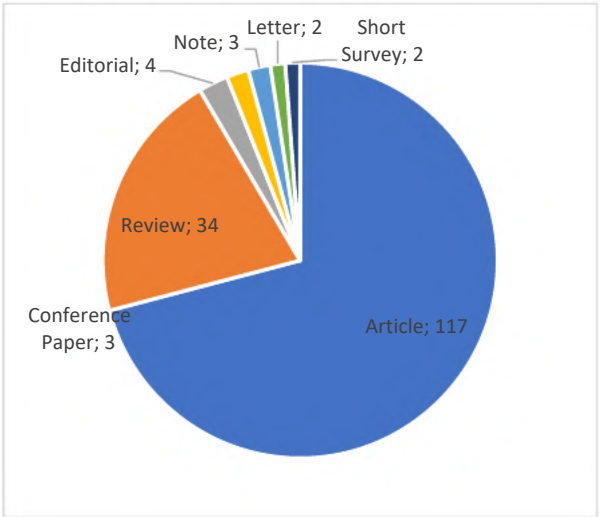

Fig.8. *Distribution of types of research publications*

In the data collected, there were several types of documents published by all researchers, out of a total of 165 studies, 117 publications of article type were

obtained; 34 review-type publications, 4 editorial-type publications; 3 conference paper type publications; 3 record-type studies, 2 letter-type publications; and 2 short survey type studies.

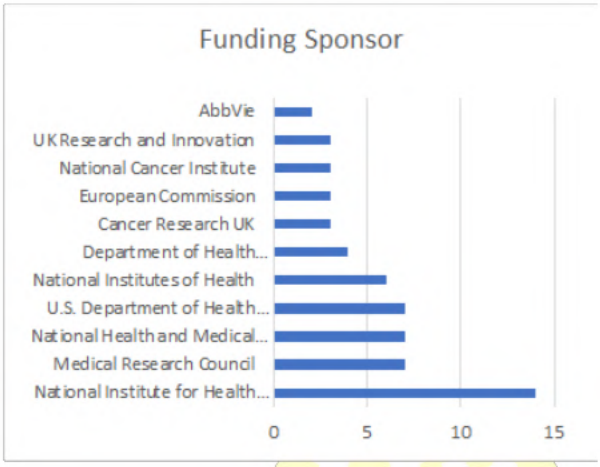

Fig.9. Distribution of research sponsors

In the total data collected, 134 funding sponsors were obtained in all studies, from the total sponsors obtained several funding sponsors with the highest number of publications namely, The National Institute for Health Research has 14 studies. Medical Research Council; National Health and Medical Research Council; U.S. Department of Health and Human Services, 7 studies each; National Institutes of Health as many as 6 studies. Australian Government's Department of Health has 4 studies. Cancer Research UK; European Commission; National Cancer Institute; UK Research and Innovation, 3 studies each and AbbVie as many as 2 studies.

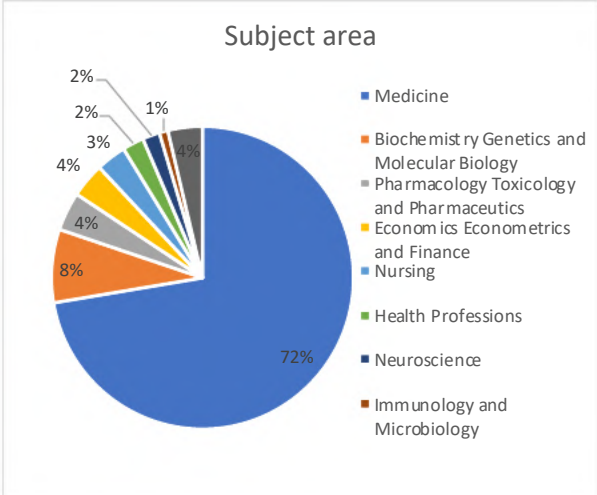

Fig.10. Distribution of research by field of research

From the total data collected, 225 studies were obtained, there were 16 subject areas among which were Medicine as many as 157 (72%) of the total data; Biochemistry Genetics and Molecular Biology 17 (8%); Pharmacology Toxicology and Pharmaceutics 9 (4%); Economics Econometrics and Finance 8 (4%); Nursing as much as 7 (3%); Health Professions 5 (2%); Neuroscience as much as 4 (2%), Immunology and Microbiology as much as 2 (1%).

Table 2. The most cited research

Tittle	Author and Year	Source	Subject Area	Cited by
Prevention and treatment of low back pain: evidence, challenges, and promising directions	[6]	New England Journal of Medicine 380(2), pp. 152-162	Medicine	620
Integration of oncology and palliative care: a Lancet Oncology Commission	[7]	The Lancet Oncology, 19(11), e588–e653.		189
Chronic hepatitis C and liver fibrosis	[8]	World Journal of Gastroenterology, pp. 11033-11053		123
Patient Blood Management Bundles to Facilitate Implementation	[9]	Transfusion Medicine Reviews, pp. 62-71		113
Patient Blood Management Bundles to Facilitate Implementation	[9]	Transfusion Medicine Reviews, pp. 62-71	Biochemistry, Genetics and	113
Implementation of a Fast-Track Clinical Pathway Decreases Postoperative Length of Stay and Hospital Charges for Liver Resection	[10]	Cell Biochemistry and Biophysics, pp. 413-419		67

Health technology assessment of belimumab: A new monoclonal antibody for the treatment of systemic lupus erythematosus	[11]	BioMed Research International	Molecular Biology	23
Surgery as a Viable Alternative First-Line Treatment for Prolactinoma Patients. A Systematic Review and Meta-Analysis	[12]	Journal of Clinical Endocrinology and Metabolism		105
Improving clinical reality in chronic obstructive pulmonary disease economic modelling: Development and validation of a micro-simulation approach	[13]	PharmacoEconomics, pp. 151-161	Health Profession	21
Economic Impact of Pneumococcal Protein-D Conjugate Vaccine (PHiD-CV) on the Malaysian National Immunization Programme	[14]	Value in Health Regional Issues, pp. 146-155		12
Estimating Health State Utility Values for Comorbidities	[15]	PharmacoEconomics, pp. 89-94		10
Cost-Effectiveness of Partially Hydrolyzed Whey Protein Formula in the Primary Prevention of Atopic Dermatitis in At-Risk Urban Filipino Infants	[16]	Value in Health Regional Issues, pp. 124-135		6
Credentialing results from IMRT irradiations of an anthropomorphic head and neck phantom	[17]	Medical Physics 40(2)	Economics, Econometrics and Finance	97
A Systematic Review of Economic Evaluations of the Use of Robotic Assisted Laparoscopy in Surgery Compared with Open or Laparoscopic Surgery	[18]	Applied Health Economics and Health Policy, pp. 457-467		25
Economic Impact of Pneumococcal Protein-D Conjugate Vaccine (PHiD-CV) on the Malaysian National Immunization Programme	[14]	Value in Health Regional Issues, pp. 146-155		12
Cost-Effectiveness of Partially Hydrolyzed Whey Protein Formula in the Primary Prevention of Atopic Dermatitis in At-Risk Urban Filipino Infants	[16]	Value in Health Regional Issues, pp. 124-135		6

The table above is obtained based on the subject area of medicine area that is the most cited in each area subject. The research title Prevention and treatment of low back pain: evidence, challenges, and promising directions [6]was cited by 630 studies; In the subject area of Biochemistry, Genetics, and Molecular Biology with the research title Patient Blood Management Bundles to Facilitate Implementation [9]cited by 113 studies; In the subject area of Health Profession with the research title Improving clinical reality in chronic obstructive pulmonary disease economic modeling: Development and validation of a micro-simulation approach [13]cited by 21 studies; In the subject area of Economics, Econometrics and Finance with the research title Credentialing result from IMRT irradiations of an anthropomorphic head and neck phantom [17]cited by 97 studies.

Table 2. *Publications with the highest citation*

Tittle	Author and year	Source	Cited by
Prevention and treatment of low back pain: evidence, challenges, and promising directions	[6]	The Lancet, pp. 2368-2383	620
Integration of oncology and palliative care: a Lancet Oncology Commission	[7]	The Lancet Oncology, pp. e588-e653	189
Coordinator-based systems for secondary prevention in fragility fracture patients	[19]	Osteoporosis International, pp. 2051-2065	163

Chronic hepatitis C and liver fibrosis	[8]	World Journal of Gastroenterology, pp. 11033-11053	123
Patient Blood Management Bundles to Facilitate Implementation	[9]	Transfusion Medicine Reviews, pp. 62-71	112
From biomarkers to medical tests: The changing landscape of test evaluation	[20]	Clinica Chimica Acta, pp. 49-57	108
The case for antifungal stewardship	[21]	Current Opinion in Infectious Diseases	90

In the table above, the publications with the highest citations without looking at the subject areas that are most cited with the research title Prevention and treatment of low back pain: evidence, challenges, and promising directions [6] cited by 620 studies; The study entitled Integration of oncology and palliative care: a Lancet Oncology Commission [7] was cited by 189 studies; The study entitled Coordinator-based systems for secondary prevention in fragility fracture patients [19] was cited by 163 studies. The study entitled Chronic hepatitis C and liver fibrosis [8] was cited by 123 studies; The study entitled Patient Blood Management Bundles to Facilitate Implementation [9] was cited by 112 studies; The study entitled From biomarkers to medical tests: The changing landscape of test evaluation [20] was cited by 108 studies; The study entitled The case for antifungal stewardship [21] was cited by 90 studies.

IV. DISCUSSION

A clinical pathway is one of the methods to achieve standardization of services in hospitals. The purpose of establishing a clinical pathway is to the benefits that will be felt by hospitals and patients as consumers. These advantages can be perceived in clinical forms among which are the improvement of the patient's live function, the reduction in the number of complications, and the increase in the success of therapy)[18].

Quality of service

In patient management using the clinical pathway should focus on the quality produced by using the clinical pathway which in practice can be proven by improving the quality of life of the patient.

By reducing patient management that does not cause benefits and improving patient management services that focus on management that benefits patients personally by considering the costs and value of benefits that will be received by patients [22].

Financial

In the journal compiled from the results of the study above, it can be found that there is a decrease in the number of costs used by health care providers and those that must be incurred by patients in the management of diseases suffered by these patients, these costs include administrative costs, disease management costs, disease control costs, the cost of complications that may occur and others [23]. This decrease in costs occurred most in the patient and disease management department [24]. In addition to lowering the number of costs incurred, the existence of a clinical pathway also increases the willingness of patients to pay costs in the management of their illnesses [25]

Workflow

Patient, management requires a way that is easy to understand and aligned with the entire journey in patient management. Improving improvements in work patterns and teamwork consisting of clinical and non-clinical will make patient disease management easier to live, especially for healthcare providers who have direct contact with patients [26].

LOS (length of stay)

In the study above, it was found that the application of clinical pathways can reduce the length of time patients are hospitalized or increase the length of time patients relapse or re-admission to the hospital after management using clinical pathways [10]with a decrease in LOS in patients will reduce the number of costs that must be incurred, complications that can be experienced by patients and psychological calm felt by patients and families.

V. CONCLUSIONS

In data collection, 301 studies were obtained related to Cost analysis and Clinical Pathway, from the total data, 4 clusters with dominant clusters were obtained namely Clinical pathway (47.5%) and Cost-effectiveness (27.5%). The highest number of studies conducted in

2019 was 24 studies. The country that conducted the most research was the United State of America with 37 studies. Most affiliations were carried out by the University of London, the University of Oxford, and the University of Sydney with 10 studies. The researchers who conducted the most studies were Fraser C., Lord, J., Vale, L. with 3 studies each. Most type of document is an article. The most research funded by the National Institute for Health Research was 14 studies. And the scientific field is dominated by Health as many as 157 (72%). In the application of the clinical pathway, it was found that there was an increase in patient management and lowered the costs that must be incurred by hospitals.

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