

**MEDICAL ETHICS:  
Research Themes and Intellectual Base**

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**ABSTRACT**

The objective of this paper is to reflect the intellectual structure of the research field in medical ethics. Central research themes of both citing and cited documents were found to focus on issues concerning autonomy, ethics education, principles of ethics, medical research and life-death decisions. An additional number of themes with delimited foci were also identified. On the basis of the findings it was concluded that the objective of describing the intellectual structure of medical ethics was not reached in terms of completeness. The data consisted of 477 bibliographic descriptions of publications of *Journal of Medical Ethics* from the period 1993-2001 and the bibliometric methods used were cocitation analysis and bibliographic coupling. Additional bibliometric applications identified and extracted documents in the sample with a citation relationship to the same and analysed the co-occurrence of descriptor terms. General statistical techniques applied were multidimensional scaling and cluster analysis.

Keywords: Bibliometrics; bibliographic coupling; citation analysis; cocitation analysis ; medical ethics

**ABSTRAK**

Tujuan penelitian ini adalah untuk mengetahui pola intelektual penelitian bidang etika kedokteran. Tema pokok penelitian dalam dokumen yang mensitir maupun yang disitir diketahui terfokus pada isu-isu otonomi, pendidikan etika, prinsip-prinsip etika, penelitian kedokteran dan keputusan untuk hidup atau mati. Sejumlah tema tambahan dengan focus terbatas juga diteliti. Dari hasil penelitian dapat disimpulkan bahwa tujuan untuk mengetahui pola intelektual etika kedokteran tidak dapat tercapai dilihat dari aspek kelengkapannya. Data yang diteliti terdiri dari 477 deskripsi bibliografis *Journal of Medical Ethics* terbitan tahun 1993-2001 dan metode bibliometri yang digunakan adalah analisis ko-sitasi dan *bibliographic coupling*. Teknik statistika umum yang digunakan yaitu pemetaan multidimensi dan analisis kluster.

Katakunci : bibliometrika; bibliographic coupling; analisis sitasi; analisis kositasi; etika kedokteran

## 1. INTRODUCTION

The basic principle of science is to publicize its research results. An emphasis on a field's publications and patterns of *formal communication* has the potential ability to reflect the cognitive structures of a scientific field. Once a discovery or research result is made public and put on permanent record, it could be said to constitute an entity of primary scientific communication and together such entities constitute an archive of public knowledge. On a personal level, such a work put on record is seen as the scientist's intellectual property. When works are read by other scientists and cited in their own works, the cited authors are *recognized* for their contribution to knowledge. These citations made and received by authors/scientist constitute a formal linking mechanism between the research published by individuals and other members of the scientific community. These previous research results to which a new research publication is linked backward in time through its citations are thus formally cited as *authoritative* sources (Ziman, 1984). As the number of publications increase, so does the number of citations constructing an expanding citation network. Any scientist's publication is thus embedded in this network constituted by the citations to and from many other scientists and depending on their work. Analyzing this network might contribute to our understanding of a field's intellectual structure and content.

In this paper the network constituted by the formal communication of researchers from the field of *medical ethics* or *bioethics* is analyzed using *bibliometric* methods. The term bibliometric has been used since the beginning of the 1970s<sup>1</sup> and refers to the mathematical and statistical analysis of patterns from publications and the use of publications. Medical ethics refers to the study of moral

issues in the fields of medical treatment and research. The term is also sometimes used more generally to describe ethical issues in the life sciences and the distribution of scarce medical resources. The professional fields that deal with ethical issues in medicine include medicine, nursing, law, sociology, philosophy, and theology, though today medical ethics is also recognized as its own discipline. For this analysis the *Journal of Medical Ethics* was chosen as a good representative of this field. First published in 1975, it has become a leading international journal, reflecting the whole field of medical ethics. Thus, the objective of this paper is to focus on the intellectual structure of medical ethics by analyzing the citation network constituted by references in this journal, depicting discernable research themes and the structure of the *intellectual base*<sup>2</sup>. The objective of this paper is purely descriptive.

## 2. METHOD

A bibliographic data file was downloaded from the Institute for Scientific Information's<sup>3</sup> index *Science Citation Index Expanded*. This index, accessed by the interface of *Web of Science*, contains complete bibliographic data, including cited references, citations received and author abstracts for each bibliographic item. In all, 477 articles on *Medical Ethics* from the period 1993-2001 were downloaded, formatted and appended to one file. Most of the computing was accomplished using the software Bibexcel<sup>4</sup>.

### 2.1 Citation analysis

Citation analysis encompasses a wide-ranging area of bibliometric research methods. The use of citation analysis may focus on the documents themselves, their

<sup>1</sup> The term *bibliometric* was coined by A. Pritchard in 1969 and defined as *the application of mathematics and statistical methods to books and other forms of written communication*

<sup>2</sup> The *intellectual base* is in this context the frame of references constituted by earlier works referenced by other, later works of a particular field.

<sup>3</sup> The Institute for Scientific Information (ISI) is a database publishing company, started by Eugene Garfield in 1958. The ISI database consists of three main indexes: the Social Science Citation Index, the Science Citation Index and Arts and Humanities Citation Index. All three indexes are available as databases online as well as printed.

<sup>4</sup> BIBEXCEL is a tool-box developed by Olle Persson, Inforsk, Umeå University, Sweden and designed to assist a user in analyzing bibliographic data, or any data of a textual nature formatted in a similar manner. The idea is to generate data files that can be imported to Excel, or any program that takes tabbed data records, for further processing

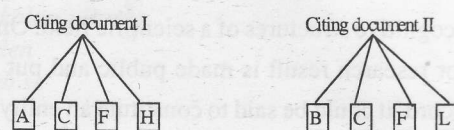
authors or the journals in which the documents appear. There is also a great variety as to how citation analysis is applied and for what purposes. To mention a few, citations can be considered as indicators of *scientific communication patterns*, where the assumption is that there is a certain amount of congruence between documental and social structures. The study of the historical, *scientific process* using citation analysis is based on a literary model of the scientific process where scientific work is represented by papers and citations can be used to trace the chronology of events, relationships between them and their importance (Smith, 1981). The study of the *cognitive structure of science*, where the linkages among key papers establishes a structure map for the specialty. Through the study of changing structures, the development of disciplines and their interrelationship could be monitored (Small, 1973).

The techniques applied for this citation analysis, bibliographic coupling and co-citation coupling, are well established. Kessler (1963) first presented bibliographic coupling as a new method for grouping technical and scientific papers on the basis of bibliographic coupling units. A coupling unit is a single reference used by two papers and the strength of the coupling is measured by the number of coupling units between them. When two citing items have a strong bibliographic coupling they are presumably dealing with the same subject matter. Vladutz and Cook (1984) performed a large-scale study of the concept of bibliographic coupling where it was found that the use of bibliographic coupling yielded valid results in terms of subject relatedness in a large-scale database.

The co-citation technique was initially presented by Small (ibid.) as a new form of document coupling defined as the frequency with which two documents are cited together. The number of identical citing items decides the strength of co-citation between two documents. Therefore, this relationship between documents is established by the citing authors and the way they choose to cite works pertinent to their own work. Like bibliographic coupling, co-citation is a measure of similarity as to subject area and

co-citation patterns can be used to model scientific specialties.

Cocitation- and bibliographic coupling can be illustrated as follows:



Document I is bibliographically coupled with document II, as they both cite document C and document F.

Documents A ; C ; F ; H are all cocited by document I

Documents B ; C ; F ; L are all cocited by document II

Documents C ; F are cocited by document I and II

Two complementary statistical techniques are applied in this paper, multidimensional scaling (MDS) and cluster analysis. Both techniques have their starting point in a matrix of proximity values<sup>5</sup>. MDS refers to a class of techniques, which use the proximity values of objects as input. The chief output is a geometric configuration of points, each point representing an object<sup>6</sup>. The display of this geometric configuration is the "map" of (co-occurring) objects. The geometric configuration could be said to reflect the "hidden structure" of the matrix and often makes the data easier to comprehend (Kruskal & Wish, 1978). The operations used to obtain the geometric configuration are highly mathematical and due to their complexity all calculations are performed with the aid of a computer, however, the principle of MDS can be explained:

Let A, B, C, and D be the representations of four objects in the matrix. Let X be the value of *similarity* for A and B, and Y for C and D. Ideally, the following conditions should be the rule:

(1) If  $X = Y$ , then the distance, between both points in the configuration, representing A and B should be the same

<sup>5</sup> A proximity value is a number which indicates how similar or how different two objects are.

<sup>6</sup> An object in this case refers to the analyzed unit of choice. In this paper documents, journals and index words are analyzed.

as the distance between the points representing *C* and *D*.  
and

(2) if  $X < Y$ , then the distance between both points representing *A* and *B* in the configuration, should be greater than the distance between the points representing *C* and *D*.

Clustering is a kind of classification of objects into meaningful sets (clusters). This classification might discover systems of organizing observations, usually people, into groups where members share properties in common (Stockburger, 1998). In this paper, a cluster could be defined as a group or a set consisting of a number of documents sharing some sort of property. The clusters should also be mutually exclusive. That is, no document may exist in more than one cluster. The routine is explained by a metaphorical example taken from the help files of Bibexcel:

Imagine you have the following list of pairs:

10	A	B
9	D	F
8	B	C
7	A	C
6	F	G
5	H	I
4	A	H

Note that the pairs are sorted by a co-occurrence frequency in column 1, and that the pair-list also must have tabs separating the two units of a pair.

The clustering routine will have the following sequence of events:

(the pairs are invited to a party):

A-B comes first, have to wait in the hall

D-F comes next, have to wait in the hall.

B-C comes next, forms a cluster-table with A-B in the living room

A-C comes next, will be deleted since A-C is already in the living room

F-G comes next, will not find a friend in the room

Goes to the hall and finds D-F and

Then D-F-G will form a cluster in the room

H-I comes next, have to wait in the hall

A-H comes next, H will cluster with A-B-C

then searches the hall and finds H-I

I will cluster with A-B-C-H

Cluster 1 will hold : A-B-C-H-I

Cluster 2 will hold D-F-G

In order to estimate interrelations ( based on co-citations) between clusters the average cocitation strengths between clusters were calculated. The *average cocitation frequency* for  $c_1$  and  $c_2$ ,  $AvgCC(c_1, c_2)$ , is defined as

$$AvgCC(c_1, c_2) = \frac{\sum_{i=1}^{n_1} \sum_{j=1}^{n_2} CC(d_i, d_j)}{n_1 n_2},$$

where  $n_1$  is the number of documents in  $c_1$ ,  $n_2$  is the number of documents in  $c_2$  and  $CC(d_i, d_j)$  the cocitation frequency for  $d_i (\in c_1)$  and  $d_j (\in c_2)$ .

Based on these normalized values (proximities) of co-citation strength, a MDS map was computed showing the relative similarity between clustered groups of documents.

## 2.2 The internal citation network

The network constituted by citations given and received exclusively by documents of a sample of selected articles from *Medical Ethics* will also be investigated. This approach demands a technique that enables the extraction of documents that cite or is being cited by other documents in the selected sample. This technique is implemented in *Bibexcel* where a search key is constructed that contains the surname of the first author, publication year, volume number and starting page for every record, which enables the identification and computing of all documents citing any other document of the sample or being cited by any of these. Next, step the number of citations to each cited document is calculated and a threshold for the inclusion of items for further analysis is set. Thus, the resulting set of bibliographic descriptions only contains documents that are connected to other documents in the original set. When this approach is applied, the whole monographic literature referenced in *Medical Ethics* hereby is excluded and references published earlier than 1993 and in journals not

indexed by SSCI are also excluded, and of course, those articles of the set that do not receive citations from articles of the same set nor give references to articles of the same. Conclusively, this gives a more concentrated view of the literature of medical ethics excluding citations to documents outside the field of medical ethics, but with notable limitations that have to be accounted for when interpreting the results.

**2.3 Word analysis**

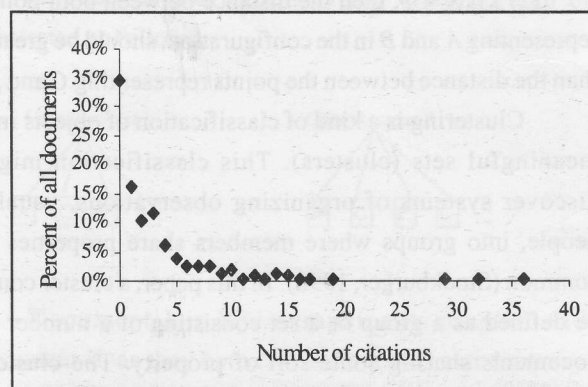
In order to investigate and comprehend the subject content of a set of source articles from a field of investigation, an additional method uses title words or key words as input data. The assumption is that the frequency and co-occurrence of terms can reflect the content and structure of research. In this paper descriptor terms are used and after computing a pair list of co-occurring index terms, MDS is used to create a spatial configuration in two dimensions showing how concepts of medical ethics relate to one another during the time period chosen for this investigation. On a more detailed level, the co-occurrence of descriptors are analyzed in order to apprehend the context of some descriptor terms selected on the basis of their frequency of use and of their share of articles' total number of descriptors

**3. EMPIRICAL RESULTS**

**3.1 Research themes through bibliographic coupling**

The research themes derived from clusters constituted by bibliographically coupled, highly cited source documents reveal recent research themes from the *Journal of Medical Ethics* and are labeled according to the content indicated by titles and abstracts. The citation threshold of the citing documents was set to 4 citations and exactly 100 documents were cited at least 5 times. The distribution of citations over source documents shows that 35% of all source documents have not, as yet, been cited at all and that a few are heavily cited.

**Figure 1**  
**The distribution of citations**



**The distribution of citations**

Eight documents were excluded in the clustering<sup>7</sup> and in all, 49 documents of 100 had at least one common reference, constituting 6 clusters. The clusters are presented with the first author, title, publication year, volume, issue, times cited and, at the end, the number of times they appear as one of the parts of the links forming the clusters. Typically, the more connected documents appear at the beginning of each cluster and the less relevant (as to the common theme of the cluster) documents are usually located at the end. As for the relationships between clusters, cluster 2 and 3 were found to have 21 references in common, cluster 2 and 1 had one common reference and the remaining clusters no common references at all. This indicates that there probably is a greater resemblance in subject content between cluster 2 and 3 than between the other clusters. The probability that cluster 2 and 3 contain common references is of course enhanced by the fact that they also contain most documents. In all, the clusters have a clear emphasis on medical treatment and care.

**Cluster 1, *Nutrition at the End of Life***, is concerned with issues about terminal care and medical-moral issues concerning the alimentation of the patient near the end of life. **Cluster 2, *Principles of Resuscitation***, have the second most documents, which indicates that the ethical question of resuscitation is a central theme in medical ethics research. In this context questions concerning euthanasia, patient

<sup>7</sup> The exclusion of documents in the clustering process is due to the fact that they do not have any references in common with any other pair of bibliographically coupled documents.

autonomy and the age of the patient are also debated. **Cluster 3**, *Ethics of Care and Education of Ethics*, is the largest cluster and has a more general content such as the basic issues of medical ethics and in focus are educational aspects of medical ethics in the context of medical care. A more specialized theme is visible in **cluster 4**, *Clinical Trials*, where the role of uncertainty and scientific evidence as well as issues of patient and public benefit are discussed. In **cluster 5**, *Medical research*, the emphasis is on genetic issues but questions about screening and prevention and obstetrics are also debated. Finally, **cluster 6**, *Patient Autonomy*, is focused on patient autonomy in the context of refusal of blood transfusion.

#### Cluster 1

##### Nutrition at the End of Life (n=4)

Dunlop RJ/ On withholding nutrition and hydration in the terminally ill - has palliative medicine gone too far - a reply/ 1995/21/8/2

Craig GM/ On withholding artificial hydration and nutrition from terminally ill sedated patients. The debate continues/ 1996/22/7/2

Ashby M/ Artificial hydration and alimentation at the end of life - a reply to craig/1995/21/7/1

Larches VF/ Paediatrics at the cutting edge: Do we need clinical ethics committees?/1997/23/12/1

#### Cluster 2

##### Principles of Resuscitation (n=15)

Halliday R/ Medical futility and the social context/1997/ 23/8/4

Brucejones P/ Resuscitating the elderly: What do the patients want?/1996/22/12/3

Robertson GS/ Resuscitation and senility - a study of patients opinions/1993/19/14/3

Hilberman M/ Marginally effective medical care: Ethical analysis of issues in cardiopulmonary resuscitation (CPR)/ 1997/23/8/2

Orr RD/ Requests for "inappropriate" treatment based on religious beliefs/1997/23/10/2

van Delden JJM/ Deciding not to resuscitate in Dutch hospitals/1993/19/15/2

Mead GE/ Cardiopulmonary-resuscitation in the elderly -

patients and relatives views/1995/21/32/2

Mitchell KR/ Medical futility treatment withdrawal and the persistent vegetative state/1993/19/15/2

Shaw AB/ In defense of ageism/1994/20/13/2

Holm S/ Not Just autonomy - the principles of American biomedical ethics/1995/21/14/1

Schostak RZ/ Jewish ethical guidelines for resuscitation and artificial nutrition and hydration of the dying elderly/ 1994/20/6/1

Hunt RW/ A critique of using age to ration health-care/ 1993/19/5/1

Stauch M/ Rationality and the refusal of medical-treatment - a critique of the recent approach of the English courts/ 1995/21/5/1

Stevens CA/ Management of death dying and euthanasia - attitudes and practices of medical practitioners in South-Australia/1994/20/29/1

Jochemsen H/ Euthanasia in Holland - an ethical critique of the new law/1994/20/13/1

#### Cluster 3

##### Ethics of Care and Education of Ethics (n=16)

Robertson DW/ Ethical theory ethnography, and differences between doctors and nurses in approaches to patient care/ 1996/22/6/4

Sulmasy DP/ Ethics education for medical house officers: Long term improvements in knowledge and confidence/ 1997/23/10/ 3

Allmark P/ Can there be an ethics of care/1995/21/15/3

Sulmasy DP/ A randomized trial of ethics education for medical house officers/1993/19/19/3

Smith LFP/ Ethical dilemmas for general-practitioners under the UK new contract/1994/20/7/3

Green B/ Teaching ethics in psychiatry - a one-day workshop for clinical students/1995/21/7/2

Mchaffie HE/ Withholding/withdrawing treatment from neonates: Legislation and official guidelines across europe/ 1999/25/10/2

Hope T/ The Oxford practice skills project - teaching ethics law and communication-skills to clinical medical-students/ 1994/20/7/2

Mitchell KR/ Assessing the clinical ethical competence of undergraduate medical-students/1993/19/16/1

single document not cited by or citing any other document of this sample. The clusters are presented with the first author, publication year, volume number, starting page and at the end, the number of times they appear as one of the parts of the links forming the clusters. Those documents that are cited at least 15 times appear with their first authors in italics, extra bold type. Clustering the top documents of the *Journal of Medical Ethics* and those documents that are related to them reflects how research themes are formed around the more recognized documents within the period of 1993-2001 and will give a current picture of the field as reflected by this particular journal. Basically, the same or related research themes show up as in the case of clusters based on bibliographically coupled documents in section 3.1: **cluster 1**, *Resuscitating the Elderly*, has a content similar to cluster 2 (3.1) and 2 identical documents. **Cluster 2**, *Artificial Hydration and Alimentation at the End of Life*, corresponds to cluster 1 (3.1) with 3 identical documents and **cluster 3**, *Ethics of Care and Education of Ethics*, to cluster 3 (3.1) with 4 identical documents. **Cluster 4**, *Patient Autonomy*, is similar to cluster 6 (3.1) with 3 identical documents. **Cluster 5**, *Using the dead*, and **cluster 6**, *Prioritization in medicine*, reflects more specialized aspects of medical ethics not present in section 3.1. Of the remaining 9 documents, 3 are found in cluster 2, section 3.1 and 6 of them are not found in section 3:1.

**Cluster 1.**

**Resuscitating the Elderly (n=5)**

Table 1  
The distribution of citing years and cited years

Citing year	Cited year										Total
	1993	1994	1995	1996	1997	1998	1999	2000	2001		
1994	1										1
1995	10	2	5								17
1996	4	1	20	6							31
1997	3	2	6	2							13
1998	2	3	4	4	10	7					30
1999	2	3	5	7	13	10	7				47
2000	4	1	4	5	9	12	9	2			46
2001		1	3		3	2	3		1		13
Total	26	13	47	24	35	31	19	2	1		198

Table 2

**The most cited documents**

Note: The left column shows the number of citations and the right column identifies the document.

36	Nord, 1993, V19, P37
32	Mead, 1995, V21, P39
29	Stevens, 1994, V20, P41
19	Craig, 1994, V20, P139
19	Sulmasy, 1993, V19, P157
17	Iserson, 1993, V19, P92
17	Savulescu, 1995, V21, P327
16	Mitchell, 1993, V19, P230
15	Allmark, 1995, V21, P19
15	Fulford, 1993, V19, P85
15	Mitchell, 1993, V19, P71
15	Redshaw, 1996, V22, P78
15	van Delden, 1993, V19, P200

*Mead, 1995, V21, P39*, Cardiopulmonary-resuscitation in the elderly - patients and relatives views/4; Bruce Jones, 1996, V22, P286, Resuscitation decisions In the elderly: A discussion of current thinking/1; Bruce Jones, 1996, V22, P154, Resuscitating the elderly: What do the patients want?/1; Robertson, 1993, V19, P104, Resuscitation and senility - a study of patients opinions/1; Sayers, 2001, V27, P114, The value of taking an 'ethics history'/1

**Cluster 2.**

**Artificial Hydration and Alimentation at the End of Life (n=7)**

*Craig, 1994, V20, P139*, On withholding nutrition and hydration in the terminally ill - has palliative medicine gone too far/5; Craig, 1996, V22, P147, On withholding artificial hydration and nutrition from terminally ill sedated patients. The debate continues/3; *Allmark, 1995, V21, P19*, Can there be an ethics of care?/2; Ashby, 1995, V21, P135, Artificial hydration and alimentation at the end of life - a reply to Craig/1; Dickenson, 2000, V26, P254, Are medical ethicists out of touch? Practitioner attitudes in the US and

<sup>9</sup> The "clustering" or grouping of these pairs is pursued differently compared to the clustering of bibliographically coupled or cocited pairs as each pair has the same value, that is, exactly one citation exists between any two documents in a pair. Thus, in the clustering process there is no distinguishing of different strengths between documents.

UK towards decisions at the end of life/1; Dunlop, 1995, V21, P141, On withholding nutrition and hydration in the terminally ill - has palliative medicine gone too far - a reply/1; Fenwick, 1998, V24, P86, Applying best interests to persistent vegetative state - a principled distortion/1

### Cluster 3.

#### Ethics of Care and Education of Ethics (n=8)

*Mitchell, 1993, V19, P230*, Assessing the clinical ethical competence of undergraduate medical-students/5; Malek, 2000, V26, P131, Talking about cases in bioethics: the effect of an intensive course on health care professionals/ 2; *Sulmasy, 1993, V19, P157*, A randomized trial of ethics education for medical house officers/2; Robertson, 1996, V22, P292, Ethical theory ethnography, and differences between doctors and nurses in approaches to patient care/1; Savulescu, 1999, V25, P367, Evaluating ethics competence in medical education/1;

Myser, 1995, V21, P97, Teaching clinical ethics as a professional skill - bridging the gap between knowledge about ethics and its use in clinical-practice/1; Sulmasy, 1997, V23, P88, Ethics education for medical house officers: Long term improvements in knowledge and confidence/1; Tysinger, 1997, V23, P315, Teaching ethics using small-group problem-based learning/1

### Cluster 4

#### Patient Autonomy (n=5)

*Savulescu, 1995, V21, P327*, Rational non-interventional paternalism: Why doctors ought to make judgments of what is best for their patients/4; Malyon, 1998, V24, P302, Transfusion-free treatment of Jehovah's Witnesses: respecting the autonomous patient's rights / 1 ; Muramoto, 1998, V24, P295, Bioethics of the refusal of blood by Jehovah's Witnesses: part 2. A novel approach based on rational non-interventional paternalism/1; Madder, 1997, V23, P221, Existential autonomy: why patients should make their own choices/; Savulescu, 1997, V23, P108, The trouble with do-gooders: The example of suicide/1

### Cluster 5

#### Using the Dead (n=3)

*Iserson, 1993, V19, P92*, Postmortem procedures in the emergency department - using the recently dead to practice and teach/2; Ardagh, 1997, V23, P289, May we practice endotracheal intubation on the newly dead?/1; Nyrhinen, 2000, V26, P54, Ethics in the laboratory examination of patients/1

### Cluster 6

#### Prioritization in medicine (n=3)

*Nord, 1993, V19, P37*, The relevance of health state after treatment in prioritizing between different patients/2; Cohen, 1996, V22, P267, Preferences needs and QALYs/1; Rynanen, 1996, V22, P238, Random paired scenarios - A method for investigating attitudes to prioritization in medicine/1

### Single Pairs

*Fulford, 1993, V19, P85*; Ethics of research with psychiatric-patients - principles problems and the primary responsibilities of researchers; Bindless, 1998, V24, P314; The use of patients in health care education: the need for ethical justification

*Mitchell, 1993, V19, P71*, Medical futility treatment withdrawal and the persistent vegetative state; Borthwick, 1995, V21, P205, The proof of the vegetable - a commentary on medical futility

*Redshaw, 1996, V22, P78*, Research ethics committee audit: Differences between committees; Dal-Re, 1999, V25, P268, Performance of research ethics committees in Spain. A prospective study of 100 applications for clinical trial protocols on medicines

*Stevens, 1994, V20, P41*, Management of death dying and euthanasia - attitudes and practices of medical practitioners in South-Australia; Kitchener, 1999, V25, P25, Conditions required for a law on active voluntary euthanasia: a survey of nurses' opinions in the Australian Capital Territory

### Not Connected

*Van Delden, 1993, V19, P200*, Deciding not to resuscitate in Dutch hospitals



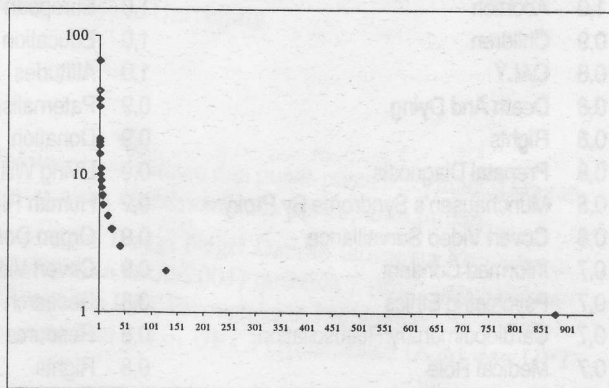
### 3.3 Concepts of research

In order to make full use of the information contained in the bibliographic descriptions, the key words that are assigned the documents by the author(s) are analyzed. The fall out of documents was acceptable as 95% of the citing documents contained descriptors. Compared to the techniques used in 3.1 and 3.2 there is no discrimination of documents and all documents containing descriptors are included. In this way most of the articles of the *Journal of Medical Ethics* have initially the same chance to make a contribution. But, on the descriptor level there is a choice of which ones to include. In this case 1911 descriptors were gathered in one file and the total number of unique descriptors was 1126, which is a number too big to be able to reflect in a meaningful way. Some sort of selection has to be made. The distribution of occurrences of unique descriptors is very skewed (Figure 2) and excluding descriptors only on the basis of low occurrence might exclude important concepts. Instead, each descriptor term was assigned a fraction according to its share of all descriptors in a particular document and all fractions of this term were then summed up (Table 3). The reason for this approach is that if a document is assigned only a single or a few descriptors, each descriptor should have a greater weight compared to the case when many descriptors are used to describe the focus of a document. As to the number of descriptors per document, the mode, median and mean are all 4<sup>10</sup>, which is a rather symmetrical distribution and one could conclude that mostly 3-6 descriptors are needed to reflect the content of a document and more seldom one or two descriptors are enough to describe the focus of a document. In another few cases more than 4 descriptors are used (Figure 3). As a good part of all descriptors occur only once (46%) over the time period, one is tempted to assume that there is no straight forward way to conceptualize research foci, or that the research field might be fragmented. This could mean that there is a problem in reflecting the research structure by means of descriptor terms. Thus, this attempt is delimited to the analysis of those

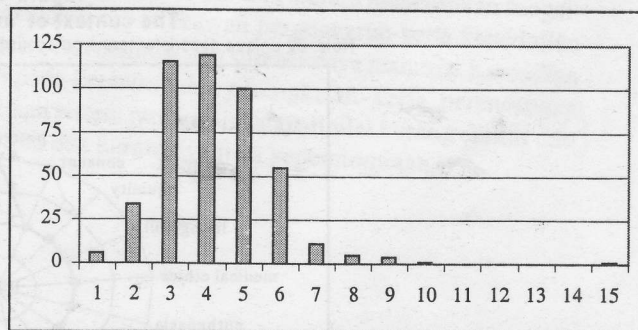
descriptors that have relative high scores<sup>11</sup> and one should keep in mind that eventually a body of varying concepts is not visualized.

In order to appreciate eventual changes over time, the set of descriptors was divided into 3 periods (Table 3). Sorting the descriptors in descending order, a few descriptors remain over the median for all three periods: *autonomy*, *ethics*, *euthanasia* and *medical ethics*. Thus, a delimited number of descriptors with relatively high scores are in focus for the whole period. It could be of some interest to understand how these relatively stable terms are related to one another and to other less central descriptors in terms of co-occurrence. For the whole period of 1993-2001, all

**Figure 2.**  
The distribution of descriptor terms  
Note: The Y-axis shows the frequency on a log scale and the X-axis number of unique descriptors.



**Figure 3**  
The distribution of number of descriptors over documents  
Note: Y axis shows number of documents and X-axis number of descriptors.



<sup>10</sup> Range = 14

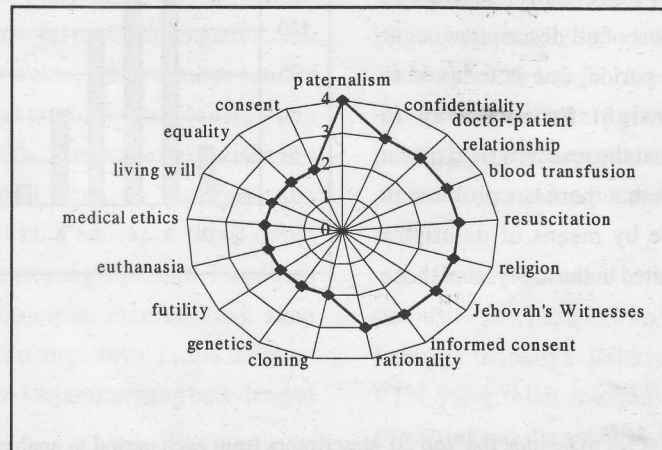
<sup>11</sup> The cut-off point for inclusion was set to include the 'top 30' descriptors from each period to enable comparison between periods.

**Table 3**  
**Descriptors, 1993-2001**

1993-1995		1996-1998		1999-2001	
Sums	Descriptors	Sums	Descriptors	Sums	Descriptors
3,8	Ethics	6,0	Ethics	5,8	Ethics
3,2	Euthanasia	4,5	Medical Ethics	4,2	Autonomy
2,3	Medical Ethics	2,0	Animal Experimentation	3,1	Euthanasia
2,2	Autonomy	2,0	Autonomy	2,6	Medical Ethics
2,2	Teaching Medical Ethics	2,0	Consent	2,2	Paid
1,9	Research	1,8	Advance Directives	2,2	Consent
1,7	Medical Education	1,8	Abortion	1,8	Confidentiality
1,5	Bioethics	1,7	Euthanasia	1,6	Informed Consent
1,2	Persistent Vegetative State	1,5	Informed Consent	1,5	Voluntary
1,2	Resource Allocation	1,5	Bioethics	1,3	Research Ethics
1,1	Clinical Trials	1,1	Religion	1,2	Cloning
1,0	Rationing	1,1	Blood	1,1	Ethics Consultation
1,0	Ethics Committees	1,1	Munchausen's Syndrome By Proxy	1,1	Eugenics
1,0	Human Experimentation	1,0	Research Ethics Committees	1,1	Genetics
1,0	Authority	1,0	European Community Directive 98	1,0	Clinical Trials
1,0	Abortion	1,0	European Community Directive 89	1,0	Disability
0,9	Children	1,0	Education	1,0	Justice
0,8	QALY	1,0	Attitudes	1,0	Ethical Review
0,8	Death And Dying	0,9	Paternalism	1,0	Religion
0,8	Rights	0,9	Donation	1,0	Abortion
0,8	Prenatal Diagnosis	0,9	Living Will	1,0	Genetic Testing
0,8	Munchausen's Syndrome By Proxy	0,9	Human Rights	1,0	Blood Transfusion
0,8	Covert Video Surveillance	0,9	Organ Donation	1,0	Jehovah's Witnesses
0,7	Informed Consent	0,9	Covert Video Surveillance	1,0	Bioethics
0,7	Psychiatric Ethics	0,8	Research Ethics	0,9	Japan
0,7	Cardiopulmonary Resuscitation	0,8	Resource Allocation	0,9	Empirical Ethics
0,7	Medical Role	0,8	Rights	0,9	Ethics Committees
0,7	Torture	0,7	Jehovah's Witnesses	0,8	Clinical Ethics Committees
0,7	Practical Reason	0,7	Research	0,8	Beneficence
0,7	Medical Skills	0,7	Clinical Research	0,8	Paternalism

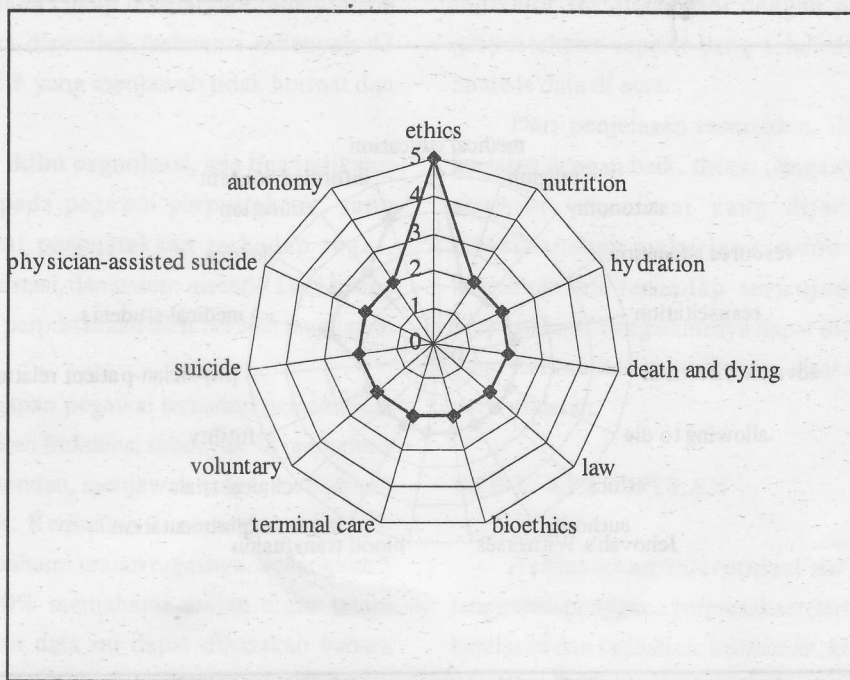
**Figure 4**  
**The context of 'autonomy'**

Note: 32 unique descriptor terms co-occurring once with autonomy excluded.



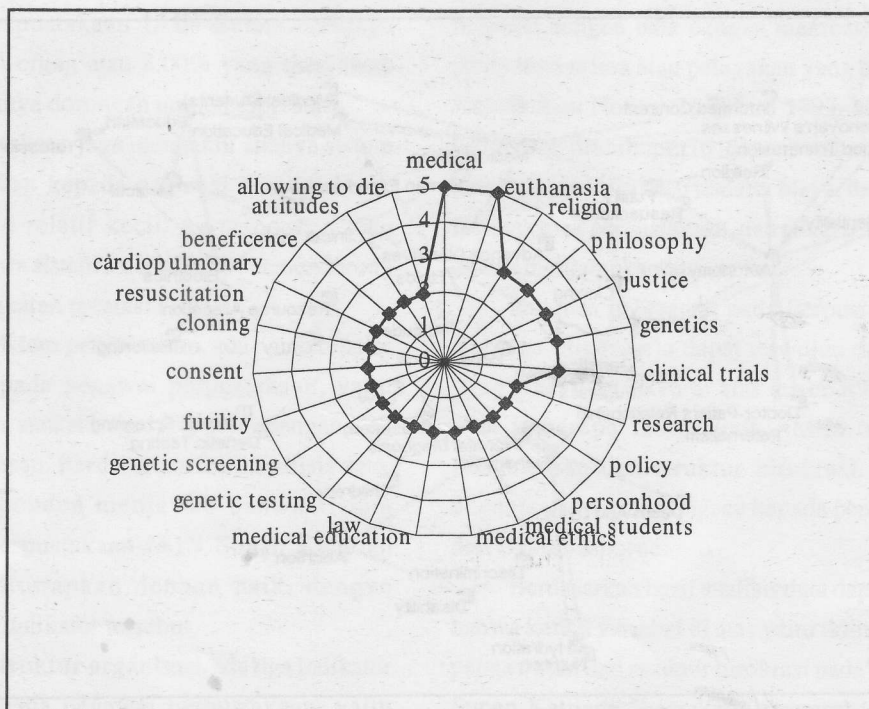
**Figure 5**  
**The context of 'euthanasia'**

Note: 15 unique descriptor terms co-occurring once with euthanasia excluded.



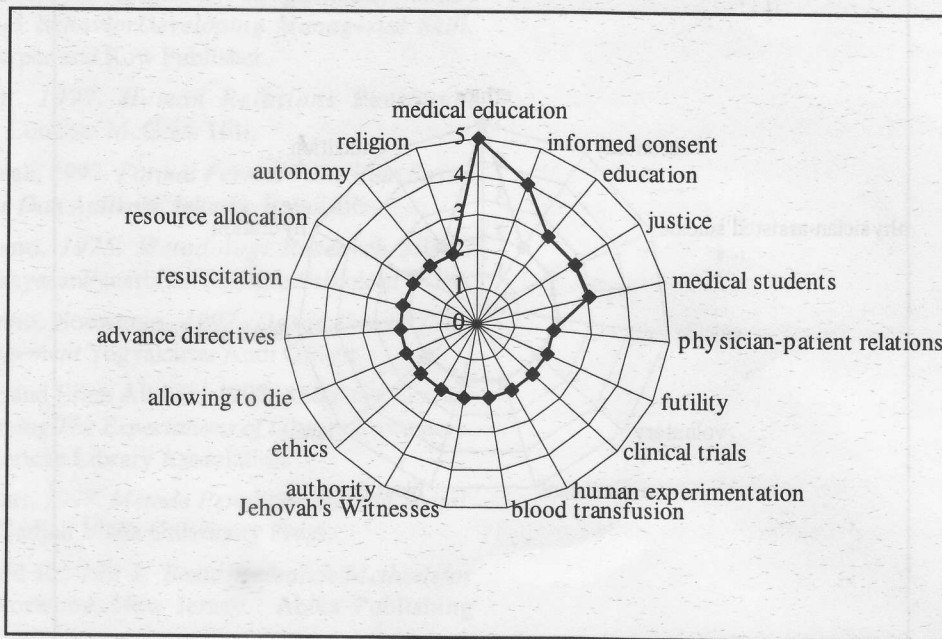
**Figure 6**  
**The context of 'ethics'**

Note: 32 unique descriptor terms co-occurring once with 'ethics' excluded.

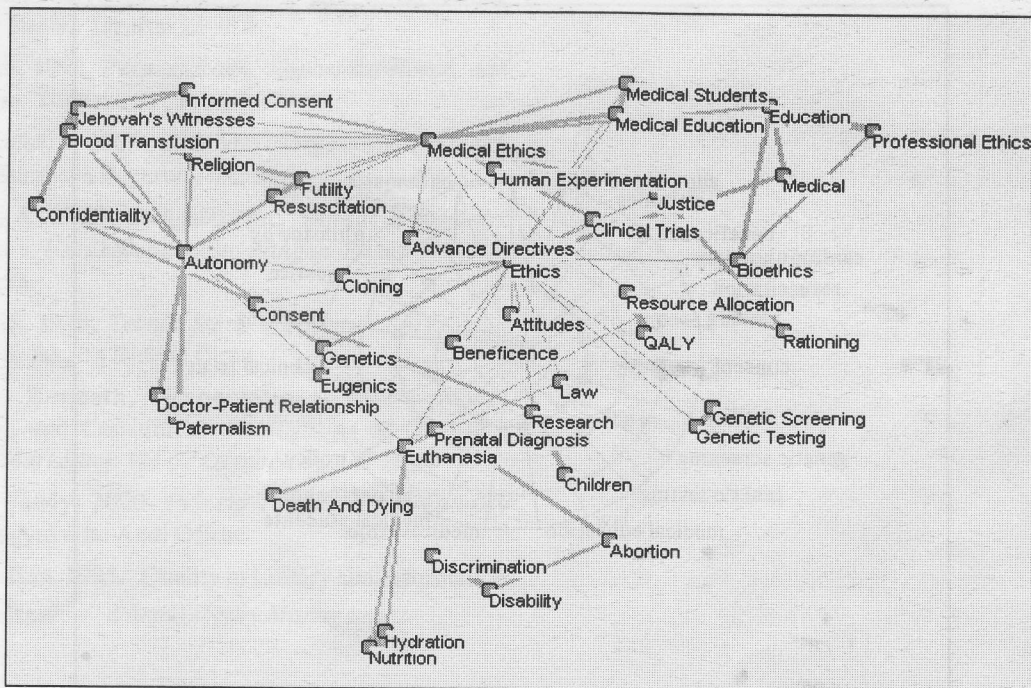


**Figure 7**  
**The context of 'medical ethics'**

Note: 26 unique descriptor terms co-occurring once with 'medical ethics' excluded.



**Figure 8**  
**Co-occurring descriptors, 1993-2001**  
 Note: n= 44, selection based on the frequency of occurrence.



terms occurring together with one of these terms are computed, showing the context of each central descriptor term (Figure 4-7). This gives us a detailed view of concepts, not obtained by the mere counting of frequencies or fractions. The descriptor *autonomy* can be seen in the context of relationships between the professional provider and the patient and religious aspects that affect treatment as well as aspects concerning *consent*. *Euthanasia* has its strongest relation with *ethics*, which indicates a basic connection to a related subject domain, but has also cognitive relations to terminal care, which reflects aspects on hydration and nutrition of the terminal patient and the process of dying. *Ethics* is foremost related to medical ethics, which is seen in the connection to medical (which seems rather redundant), and to *euthanasia*. The connections to *religion*, *justice*, *philosophy* and *genetics* indicate the use of the descriptor *ethics* in contexts that is of great common concern for society. The descriptor *medical ethics* (as well as its synonym *bioethics*) is, of course, very general in this context but seems to relate foremost to aspects of education and the remaining links are dispersed to a variety of descriptors. Looking at all descriptors above the cut-off point over all 3 periods, the descriptors *abortion*, *bioethics* and *informed consent* can be added to a set of descriptors that seem to remain stable for the whole period. Using MDS, an overall view of term relations could be visualized (Figure 8), but as there has to be a limitation as to how many objects that can be contained in a 'map' only the more frequent terms are included, which means that a more complete comprehension of term relations on a more detailed level requires several graphs that display a majority of the terms relating to a certain, selected term. Still, the map of co-occurring terms is relatively easy to interpret as to central vs. peripheral locations: *autonomy*, *euthanasia*, *ethics* and *medical ethics* all hold central positions on the map in terms of having several connections to more peripheral terms.

One could also look at the specific character of each period (Table 3). The period 1993-1996 includes a focus on medical ethics as a subject and the teaching of medical ethics. During 1996-1998 *consent* and *informed consent* and the question of *patient autonomy* in the context of *blood-refusal* is debated. The debate on *blood-refusal* as

well as the debate on *consent* and *informed consent* is continued in 1999-2001 and a group of new concepts that seemingly seem to cohere, at least intellectually, emerge: *cloning*, *eugenics*, *genetic testing* and *genetics*. In the same context there is an emphasis on *ethics committees* and *research ethics*. On the whole, it is hard to decide on a specific character for each period, but obviously there is a difference between the periods as to the emphasis of subject content in their articles. Conclusively, this analysis approach gives insights into which major concepts, as reflected by the use and combination of descriptor terms, that have a central meaning to the field.

### 3.4 The intellectual base of *Journal of Medical Ethics*, 1993-2001

#### 3.4.1 Document types and journals

The intellectual base of the *Journal of Medical Ethics* is constituted of a total of 7412 unique references. In order to reflect the distribution of citations to the more cited items, citations to non-journal items as well as to journal articles were counted and a rank ordered listing was produced to show the top journals as well as the top non-journal items cited (Table 4). Not surprisingly, most of the journal articles cited at least 4 times are from the *Journal of Medical Ethics* and 37% of the citations to articles are self-citations at journal level. In all, 28 % of the citations to items cited at least 4 times are directed to non-journal items and 72% to journal articles. As for the total number of citations, 2875 or 39% are to non-journals. This means that the intellectual base of the *Journal of Medical Ethics*, to a greater extent, can be traced to journal articles and, to a lesser extent, to books. In order to get a general view of the citations to journals, the total distribution of citations to journals was calculated (Table 5). Comparing Table 4 and Table 5 as to the 10 top positions one can see that two new journals have entered in Table 5: *Hastings Center Report*, which is a genuine medical ethics journal, and *Social Science and Medicine*. The two journals that lost their prominent more positions were the *Journal of Clinical Ethics* and the *Journal of the Royal College of Physicians of London*. In all, the dominance of journals not exclusively focusing on medical ethics is obvious.

**Table 4**  
**The rank order of journal articles & non-journal items**

Note: The rank order is based on the distribution of citations to items cited at least 4 times by documents in the Journal of Medical Ethics, 1993-2001. Journal articles are merged to the journal in which they are published.

Rank	Journals	Rank	Non-journals
1	Journal of Medical Ethics	1	Beauchamp TL, 1994, Principles Biomedica
2	New England Journal of Medicine	2	Beauchamp TL, 1989, Principles Biomedica
3	British Medical Journal	3	British Medical Association, 1999, Withholding and withdrawing life-prolonging medical treatment
4	Annals of Internal Medicine	4	Parfit D, 1984, Reasons and persons
5	Journal of the American Medical Association	5	Rawls J, 1971, A theory of justice
6	Archives of Internal Medicine	6	Duster T, 1990, Backdoor eugenics
7	Academic Medicine	7	Gillon R, 1994, Principles of health care ethics
8	Journal of Clinical Ethics	8	Buchanan AE, 1989, Deciding for others
9	Journal of the Royal College of Physicians of London	9	Gilligan C, 1982, In a different voice
10	Lancet	10	The Royal College of Physicians, 1990, Guidelines on the practice of ethics committees in medical research involving human subjects

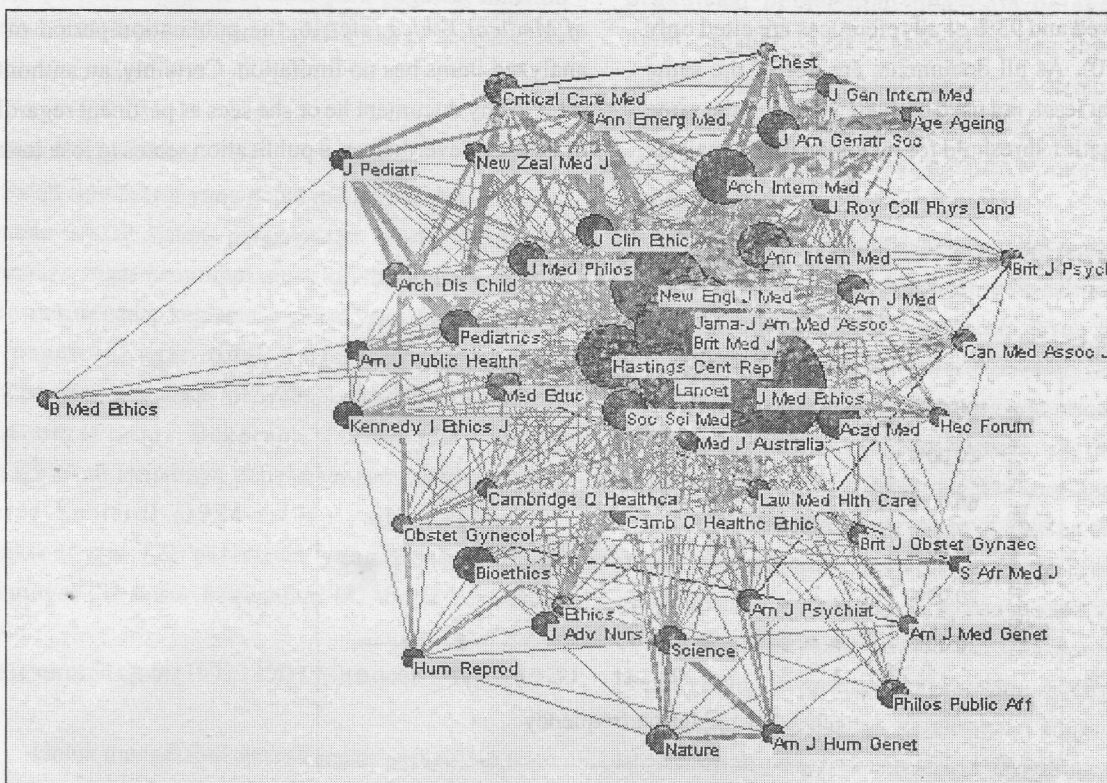
**Table 5**  
**The distribution of citations to journals**  
**cited by documents published in Journal of Medical Ethics, 1993-2001**

Note: Only journals cited at least 30 times shown.

# citations	Journal title
465	Journal of Medical Ethics
334	British Medical Journal
222	New England Journal of Medicine
190	Journal of the American Medical Association
131	Lancet
128	Hastings Center Report
97	Archives of Internal Medicine
71	Annals of Internal Medicine
50	Social Science and Medicine
49	Academic Medicine
46	Medical Journal of Australia
45	Journal of The American Geriatrics Society
42	Bioethics
40	Journal of Medicine and Philosophy
39	Pediatrics
34	Journal of Clinical Ethics
33	Medical Education
31	Critical Care Medicine
30	Journal of the Royal College of Physicians of London

**Figure 9**  
**Journal Cocitation map**  
**Journals cited by Journal of Medical Ethics, 1993-2001**

Note: Only journals cited at least 10 times, a total of 48 journals, were included.  
 The circle size is proportional to the number of citations received by a journal and the width of connecting lines to the co-citation strength. Journal titles are abbreviated.



It can be of interest not only to know about the degree of visibility or use reflected by the number of citations received by journals, but also to reflect the structure of the intellectual base on journal level and appreciate the whole pattern of relations between journals cited by *Journal of Medical Ethics*. In order to accomplish this, a journal cocitation map, based on the number of times that journals in the reference lists of documents from the *Journal of Medical Ethics* co-occur, was produced by means of MDS (Figure 9). The relations between journals and the spatial configuration of the map could be viewed in a center-periphery manner: in the center, a core is constituted by the most cited journals and corresponds well with the listing of highly cited journals in Table 5, while less cited journals are located in the periphery. Peripheral journals in this

context represent a wide spectrum of journals focused on different aspects of medical research: cardiovascular & respiratory diseases, critical care, emergency medicine, genetics, geriatrics, internal medicine, obstetrics and pediatrics. Other fields of research present in the periphery are nursing science and philosophy, medical education and law medicine. To conclude, it is obvious that a few, highly cited journals from the field of medical ethics as well as a few journals with a general medical focus construct the core. An additional number of journals on medical ethics like *Bulletin of Medical Ethics*, *Bioethics*, *Cambridge Quarterly Healthcare Ethics* and *Kennedy Institute of Ethics Journal* are quite distant from the core and thus more seldom cocited with journals of the same.

The circle size is proportional to the number of citations

received by a journal and the width of connecting lines to the co-citation strength. Journal titles are abbreviated.

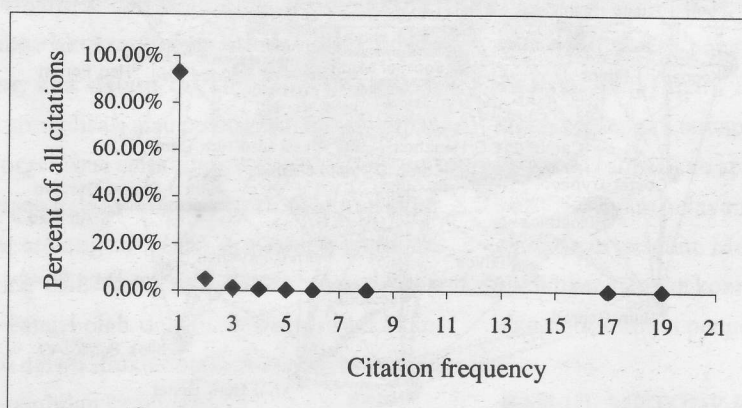
### 3.4.2 The cluster structure of the intellectual base

The distribution of citations by cited documents is extremely skewed and 93% of all references are cited only once (Figure 10). As all documents are not of the same importance, or at least, not used or made visible to the same extent, some citation threshold for inclusion in the analysis

content of the citing documents. However, it seems valid, to a certain extent, that there should be a resemblance between the subject content of the cited documents and the subject content of the citing documents.

Looking at the literature that authors in the *Journal of Medical Ethics* refer to, the publication period of the analyzed items has no limitation. Certainly, an author can refer to any document he or she sees as pertinent regardless of its age. Nevertheless, a publication seems to lose interest

**Figure 10**  
The distribution of citations



has to be decided on.

In this case all documents cited at least 4 times were included, constituting a set of 55 documents. The resulting clustering produced 6 clusters, containing 53 documents, which are represented with the number of objects per cluster, the median publication year and number of citing documents. The objects in the clusters are presented with author name, publication year, volume number, starting page, abbreviated journal title, number of citations and, at the end, the number of times they appear as one of the parts of the links forming the clusters. In order to interpret and label the clusters, all documents citing a particular cluster are collected and titles, abstracts, identifiers and descriptors are studied. Thus, the labeling of clusters is based on the

for readers the older they are and more recent publications are usually more visible through their use as reflected by citations received<sup>12</sup>. In accordance with this notion, the mean *median publication year* is 1994, which means that relatively recent publications are among the more cited documents selected.

Scanning the labels of these clusters, it is obvious that the subject content of the intellectual base does not diverge radically from the content of clusters based on the citing documents in section 3.1 and 3.2. As far as the authors of the *Journal of Medical Ethics* base their articles on previous knowledge and results contained in their referenced publications, this should to some extent be reflected in the subject content of their own articles as well

<sup>12</sup> This is certainly the case for the literature of science whereas the social sciences and arts & humanities have a different aging scheme.



as in their titles and assigned key words. Nevertheless, new themes can be seen to emerge, where referenced items are seen in a new light and linked together in new combinations by the way they are cocited. The subject-content dimension is rather clear: clinical aspects of medical ethics are reflected by **cluster 1, 2, 4 and 5**, while a more general theme of ethics in connection with education is reflected by **cluster 3**, which also is the largest cluster.

Using MDS, it is possible to reflect the interrelations between clusters by counting the number of times that documents of clusters are cocited with documents of other clusters (Figure 11). As there are differences in the number of objects in each cluster, the mean cocitation strength between clusters is calculated as presented in section 2.1. The most related clusters are **cluster 5** and **cluster 6** and apparently, as indicated by similar labels, they focus on similar research topics and it is in fact not unlikely that they are part of the same 'specialty' of medical ethics research. Proportionally, they seem to be equally cited and the median publication year is about the same. Thus, the concept of autonomy is connected to the concept of life-death decisions and through **cluster 3** connected to aspects of education and ethical principles. The latter cluster has the most central position indicating that aspects of ethics and education are connected to several themes of medical ethics. **Cluster 1 - Clinical- and Research Ethics Committees** – have weak connections to **cluster 5** and **6** but is more related to **cluster 3 - Ethical Principles in Health Care and Teaching Ethics**. **Cluster 2, Patient Autonomy – Transfusion-free Treatment** – is the 'youngest' cluster and has its only connection with **cluster 5**, connecting the concept of autonomy in the context of transfusion-free treatment with autonomy in the context of life death decisions. **Cluster 4** reflects a delimited aspect of medical ethics research and is not connected to any other cluster.

Obviously, the time factor has some importance as to how documents cohere in terms of being cocited and the connection of a certain aspect of research with another is to some extent due to this time factor and possibly both size and connections to other clusters will increase with time for a 'young' cluster reflecting a relatively new research theme.

### Cluster 1

Clinical- and Research Ethics Committees  
(N=9, median publication year=1995, number of citing documents=22)

Thornton JG, 1995, V311, P667, Brit Med J/4/4; Gilbert C, 1989, V299, P1437, Brit Med J/8/3; Garfield P, 1995, V311, P660, Brit Med J/4/2; While AE, 1995, V311, P661, Brit Med J/4/2; Gillon R, 1997, V23, P203, J Med Ethics/5/1; Harries UJ, 1994, V28, P150, J Roy Coll Phys Lond/4/1; Royal Coll Phys, 1990, Guid Pract Eth Comm/4/1; Brit Med Ass, 1999, Withh Withdr Lif Pro/6/1; Craig GM, 1994, V20, P139, J Med Ethics/4/1

### Cluster 2

Patient Autonomy – Transfusion-free Treatment  
(N=3, median publication year=1998, number of citing documents=6)

Muramoto O, 1998, V24, P223, J Med Ethics/6/2; Malyon D, 1998, V24, P376, J Med Ethics/4/1; Muramoto O, 1998, V24, P295, J Med Ethics/4/1

### Cluster 3

Ethical Principles in Health Care and Teaching Ethics  
(N=15, median publication year=1990, number of citing documents=49)

Hebert P, 1990, V16, P141, J Med Ethics/6/5; Culver CM, 1985, V312, P253, New Engl J Med/8/4; Beauchamp TL, 1994, Principles Biomedica/19/3; Parfit D, 1984, Reasons Persons/5/2; Sulmasy DP, 1993, V19, P157, J Med Ethics/4/2; Buchanan AE, 1989, Deciding Others Ethi/4/2; Mitchell KR, 1993, V19, P230, J Med Ethics/5/2; Gillon R, 1994, V309, P184, Brit Med J/5/1; Miles SH, 1989, V64, P705, Acad Med/5/1; Hebert PC, 1992, V18, P142, J Med Ethics/4/1; Duster T, 1990, Backdoor Eugenics/4/1; Pellegrino ED, 1990, V1, P175, J Clin Ethics/4/1; Pellegrino ED, 1992, V268, P1734, Jama-J Am Med Assoc/4/1

Sulmasy DP, 1990, V150, P2509, Arch Intern Med/4/1; Gillon R, 1994, Principles Hlth Care/4/1

**Cluster 4**

Covert Video Surveillance

(N=3, median publication year=1995, number of citing documents=6)

Evans D, 1995, V21, P9, J Med Ethics/4/2; Southall DP, 1987, V294, P1637, Brit Med J/4/1; Southall DP, 1995, V21, P104, J Med Ethics/4/1

**Cluster 5**

Autonomy and Life-Death Decisions

(N=14, median publication year=1991, number of citing documents=51)

SE, 1983, V309, P569, N Engl J Med/5/1; Tomlinson T, 1990, V264, P1276, Jama-J Am Med Assoc/5/1

Emanuel LL, 1991, V324, P889, New Engl J Med/5/1; Vanderwal G, 1996, V335, P1706, New Engl J Med/4/1; Bakhurst D, 1992, V18, P63, J Med Ethics/4/1

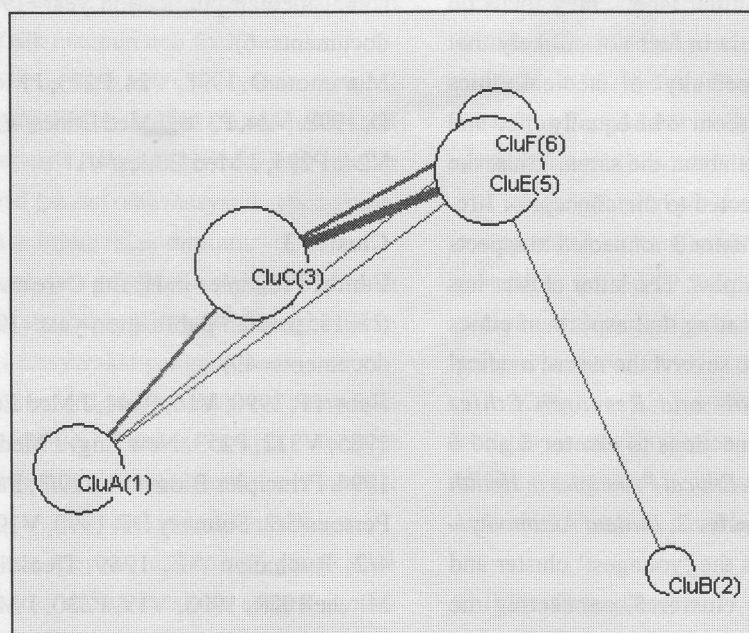
**Cluster 6**

Life-Death Decisions

(N=8, median publication year=1990, number of citing documents=25)

Morgan R, 1994, V308, P1677, Brit Med J/5/4; Jonsson

**Figure 11**  
Interrelations between cocitation-clusters



Note: Circle sizes are proportional to the number of objects in clusters and width of lines to the average cocitation-strength between clusters.

Schneiderman LJ, 1990, V112, P949, Ann Intern Med /8/5; Beauchamp TL, 1989, Principles Biomedica/17/4; Wreen MJ, 1991, V17, P124, J Med Ethics/6/3; Blackhall LJ, 1987, V317, P1281, New Engl J Med/4/3; Truog RD, 1992, V326, P1560, New Engl J Med/4/3; Jackson J, 1991, V17, P5, J Med Ethics/5/2; Gilligan C, 1982, Different Voice/4/1; Orr RD, 1997, V23, P142, J Med Ethics/4/1; Savulescu J, 1995, V21, P327, J Med Ethics/4/1; Bedell

PV, 1988, V148, P2373, Arch Intern Med/4/3; Murphy DJ, 1994, V330, P545, New Engl J Med/4/2; Duff RS, 1973, V289, P890, New Engl J Med/4/1; Rawls J, 1971, Theory Justice/5/1; Seckler AB, 1991, V115, P92, Ann Intern Med/5/1; Vandermaas PJ, 1991, V338, P669, Lancet/4/1; Wanzer SH, 1989, V320, P844, New Engl J Med/5/1

**CluA**(1), Clinical- and Research Ethics Committees; (N=9, median publication year=1995, number of citing documents=22)

**CluB**(2), Patient Autonomy – Transfusion-free Treatment; (N=3, median publication year=1998, number of citing documents=6)

**CluC**(3), Ethical Principles in Health Care and Teaching Ethics; (N=15, median publication year=1990, number of citing documents=49)

[Cluster 4, Covert Video Surveillance; (N=3, median publication year=1995, number of citing documents=6). No documents of cluster 4 is cocited with any documents of the other clusters.]

**CluE**(5), Autonomy and Life-Death Decisions; (N=14, median publication year=1991, number of citing documents=51)

**CluF**(6), Life-Death Decisions; (N=8, median publication year=1990, number of citing documents=25)

#### 4. DISCUSSION AND SUMMARY

Based on the assumption that the *Journal of Medical Ethics* is a prominent representative for the field of medical ethics, the object of this paper has been to examine if its content can reflect the intellectual structure of the field. It was found that core journals in the journal cocitation structure comprised several journals not explicitly focused on medical ethics. It is not clear to what extent cited publications in these journals focus on mere medical ethics issues or on medical-clinical issues. Furthermore, a number of journals with a clear emphasis on medical ethics were found to be cocited to a lesser extent by the *Journal of Medical Ethics*. Therefore, the result is indicative and not an exhaustive reflection of all possible research foci in the field.

Concerning the description of subject content, a number of research foci or research themes have been identified. Educational aspects and ethical principles is a pronounced theme of the intellectual base, represented by the largest and most central cluster. Autonomy and ethical aspects of life-death decisions is another pronounced theme and so is medical research ethics in a clinical context. Other

more peripheral and delimited foci concern blood transfusion in a religious context, and covert surveillance.

The analysis of documents linked by bibliographic coupling visualized clinical aspects of medical ethics through clusters dealing with ethical problems of resuscitation and nutrition at the terminal stage. The largest cluster is concerned with issues about the ethical principles of 'care and ethics education'. The ethics of medical research and patient autonomy were two additional themes.

Clustering documents that cite or are cited by other documents in the *Journal of Medical Ethics* during the period 1993-2001, the objective was to see how research themes are formed around the top-cited documents of this particular journal and thus reflect this journals' internal, formal communication. The research themes were in large found to be similar to those found in clusters based on bibliographic coupling, though a few new research themes emerged.

The analysis of words gave insights into which major concepts that have a central meaning to the field, reflecting the use and combination of descriptor terms. *Autonomy*, *ethics*, *euthanasia* and *medical ethics* were found to be used frequently over 3 consecutive periods. The context of these terms was analyzed as to co-occurrence with other terms and provided a more detailed understanding of each term. A general view of term relations by means of MDS based on co-occurrences further ascertained the cognitive context of more frequent descriptor terms. Over the time period of this investigation a few terms have remained stable and a large share of low frequency descriptors indicate difficulties in describing the **research structure on this basis**.

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