

Why ClinMicroNet works: the study of an Internet Discussion Group as a Knowledge Network

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ABSTRACT

ClinMicroNet is a closed IDG, where doctoral level Clinical Microbiologists from many countries share their knowledge and experience, to promote better professional practice and greater understanding of practical problems. This collaborative approach to resolving issues and doubts in the field of clinical microbiology transcends organizational, institutional, state and national boundaries.

Observing list communication during a 3 month period and conducting a small group user survey, this study analyses the nature of communication within the network and members' perceptions of its value. Through the use of an explicit/tacit knowledge quadrant, distinct ways in which knowledge is transferred and created are identified.

Empirical evidence shows that ClinMicroNet is more than an Internet Discussion List. It complements other existing resources by encouraging members to share experiences and collaborate in establishing best practices. Driven by a core group of active members, the network is highly participative and strongly supported. In turn, members maintain professional relationships beyond the list, which reinforces the network and the members' capacity to confront new threats and challenges in clinical microbiology.

KEYWORDS

knowledge management, knowledge networks, internet discussion groups, clinical microbiology.

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Research Paper: The Information and Knowledge Society

Why ClinMicroNet works:

– the study of an Internet Discussion Group as a knowledge network

The ClinMicroNet is an internet e-mail discussion group started in 1995 by Mike Miller and is composed only of doctoral level Clinical Microbiology Laboratory Directors and managers of national reputation within ASM. Currently we have over 400 members worldwide. Using this forum, questions and problems from members are posed daily that receive the responses and experience of internationally known microbiologists. This is an exciting, powerful, and efficient method of communication among laboratory professionals that has become highly influential within the clinical microbiology community. The only "requirement" is that on occasion when we have a serious need to "vote" on something or to take a stand on an issue, that you be willing to respond, regardless of your position on the issue.

(Description of ClinMicroNet provided for new members).

Abstract:

ClinMicroNet is a closed IDG, where respected Clinical Microbiologists share their knowledge and experience, with a clear objective of promoting better professional practice and greater understanding of the problems faced. The collaborative approach to resolving doubts in the field of clinical microbiology transcends organizational, institutional, state and national barriers. One might expect that a strong professional bond is an essential feature of this knowledge network, and the common focus on controlling a problem that does not respect these boundaries is an essential motive for sharing information.

This study analyses the nature of communication within the network and through a member survey analyses the perceived value of the network and information exchanged. Through the use of an explicit/tacit knowledge quadrant, distinct ways in which knowledge is transferred and created are identified.

Empirical evidence shows that ClinMicroNet is more than an Internet Discussion List. It complements other existing resources by encouraging members to share experiences and collaborate in establishing best practices. In turn, members maintain professional relationships beyond the list, which reinforces the network and their capacity to confront new threats and challenges in clinical microbiology on a daily basis.

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Introduction

In the context of “The Information and Knowledge Society PhD Program”, the objective of this research was to observe the workings of ClinMicroNet, describe its structure and through a user survey, analyze the member perception of the network and the value derived from the exchange of information.

A conversation over dinner at a course run by a company in Stockholm was followed up by an invitation from a Microbiologist in New York to a Microbiologist in Barcelona to join the ClinMicroNet. That was the end of April 2001. Some six months later New York and the world were shaken by the twin tower terrorist attacks and the subsequent fears of bio-terrorism in the form of letters laced with anthrax brought the work of Microbiologists to the fore. ClinMicroNet buzzed with numerous exchanges on testing protocols and previous anthrax detection experience in hospitals across the United States and around the world.

What type of information is exchanged? How many people participate? What value do people extract as members of the ClinMicroNet?

A research proposal was presented to the ClinMicroNet administrator to observe and analyze this Internet Discussion Group as a knowledge network. With the endorsement of the ASM (American Society of Microbiology), research commenced.

Study Period and data collection:

Messages from ClinMicroNet between 15 March and 31 May 2002 were studied. During this period more than 760 messages were posted to the list by 171 different members (42.3%). The member survey was sent to 85 of the 405 members on the list provided. The response rate was 38%, with 33 completed surveys analyzed to evaluate user perceptions of the network.

Documents provided by the list administrator, Dr Miller, on ClinMicroNet membership, basic principles, list of members, etc. were reviewed. E-mails exchanged with Dr. Miller on various matters relating to ClinMicroNet provided additional information. After the research period concluded some additional questions were raised regarding the research findings.

Analytical framework:

ClinMicroNet is analyzed as a professional knowledge network. Using a tacit/explicit knowledge quadrant, examples are provided of knowledge creation. The questionnaire was designed to explore how ClinMicroNet complements other knowledge resources, and measure the perceived value of the network amongst surveyed members.

Academic support for the study is drawn from work on knowledge management (Ikujiro Nonaka), social networks (Barry Wellman) and Uwe Matzat's study of academic networks¹, which examines different models for understanding individual motivation in Internet Discussion Groups.

¹ Social Networks and Cooperation in Electronic Communities – Matzat, Uwe Doctoral Thesis presented 6 December 2001, Rijksuniversiteit Groningen, Holland

Defining the research question: What the study aims to explore

- I Why is ClinMicroNet successful?
- II What is the nature of list communication?
- III What is the user perception of ClinMicroNet?
- IV What type of knowledge is transferred?
- V What impact does ClinMicroNet have beyond its members?

- I Why is ClinMicroNet successful?

Expectations:

- Common interest in subject matter and types of problems
- Good response rate to issues raised
- Complementary to other resources
- Existence of clear guidelines and support structure

- II What is the nature of list communication?

- Which of the following patterns can be identified:

One to Many; Many to One; Many to Many; On List – Off-list; Existence of core group; Existence of Sub-groups by subject area.

- Characteristics observed in IDG:

Different value of messages; A few messages generate majority of traffic; Sociability

Hypothesis 1

Members who have strong off-list networks with other ClinMicroNet members have been members for longer and tend to be more active.

- III What is the user perception of ClinMicroNet? (ClinMicroNet member survey)

Expectations:

- Tacit knowledge more valued than explicit knowledge
- Definition of best practices through group
- Access to expert opinions especially valued

Hypothesis 2

The sharing of tacit knowledge is more highly valued than other information which can be obtained from alternative sources.

- IV Knowledge creation: What type of knowledge is transferred?

Expectations:

- Both tacit knowledge and explicit knowledge are transferred.
- Identification of process of knowledge creation

- V What impact does ClinMicroNet have beyond its members?

Expectations:

- Knowledge exchanged on ClinMicroNet has an impact beyond network – Case of Anthrax (circles of influence)

Definitions:

Explicit knowledge refers to established procedures and documented research findings. So called hard facts and established norms, as well as scientific evidence.

Tacit knowledge is defined as individual “know-how” concerning undocumented procedures and practices, and experience in the use of procedures and practices in the laboratory. Tacit knowledge also extends to the ideals, values and emotions that individuals embrace in carrying out their work.

I Why is ClinMicroNet successful

Initial impressions are often useful in pinpointing key areas to explore and the features of greatest interest. A review of the workplaces in the list of members made it clear that there was little institutional dominance in this network. Most members were the sole representative from their hospital or university, and few lived in the same town or city. In fact, whilst 88% of the just over 400 members lived in the United States, they came from 40 different states and over 200 cities across the country. With the exception of the CDC and a few universities, where several people from the same organization are on the list, the vast majority of individuals are sole representatives of the hospital, laboratory, university or health organization where they are employed.

Activity was constant, with new issues being raised on an almost daily basis. The nature of communication made it clear that ClinMicroNet was a work resource, a knowledge co-operative that enabled highly specialized professionals in different locations to share experiences and pool their knowledge. It was most active during the US working day as most contributions were made during the members' working hours.

The familiar tone of some messages suggested that this was a personal network. Some members had developed a degree of familiarity within the Internet Discussion Group (IDG) or beyond it.

Conditions to create an effective Internet Discussion Group

As ClinMicroNet attracts members of a very specific professional community, it is clear that there is a common identity, a common problem and a common objective. Members recognize one another through their publications and the hospital or university they work in, providing an element of trust. Furthermore, the opportunity to meet at conferences reinforces the spirit of cooperation and collaboration fostered by the network. In this respect, ClinMicroNet meets three basic conditions identified by Peter Kollock when considering design principles for online communities²:

- 1) It must be likely that two individuals will meet again in the future.
- 2) Individuals must be able to identify each other.
- 3) Individuals must have information about how the other person has behaved in the past.

ClinMicroNet was established in 1995, so it is a consolidated network with a mature membership base. The level of activity (topics raised/ messages sent) and involvement of its members (42% active during study period of ten weeks) is a further measure of its success.

There are clear rules, but little need to enforce them, as members seldom stray from the common objective. The list administrator adopts a policy of sending gentle reminders every few months or if he detects a certain move away from the stated objective of the list, but there is no filtering or control over what is discussed.

Questions which can be replied to quickly generate more answers than those requiring more detailed explanations, as one would expect. The greatest structural constraint noted as a possible explanation of lower participation was time-zone, where it could be argued that those outside the North American time zone are less likely to participate given that many issues are resolved within the working day.

² Design Principles for Online Communities: Kollock 1996. Harvard Conference on the Internet and Society. Also published in PC Update 15(5): 58-60. June 1998.

Positive Reinforcement

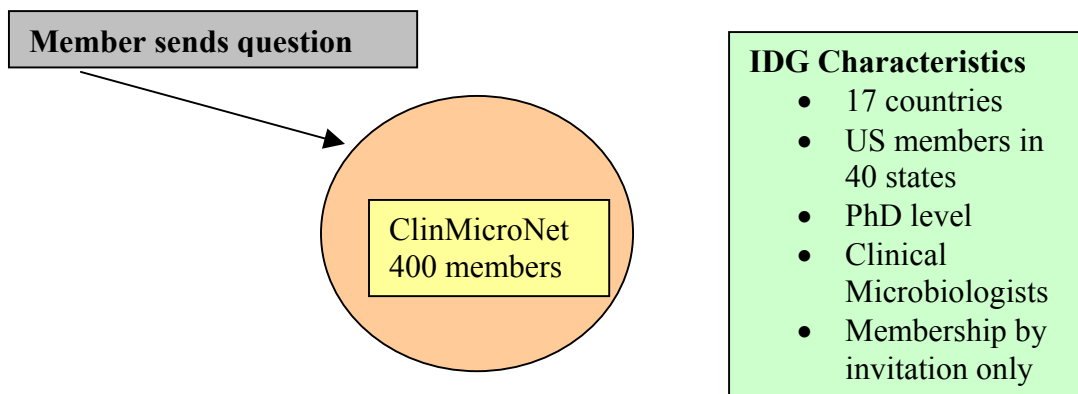
Results of the member survey indicate that those members who are more active online maintain contact with a larger number of members off-line, suggesting that online contact reinforces off-line relationships in line with Wellman's³ research findings on social networks. The old adage that the more you put into something, the more you get out of it would appear to hold true, at least as far as personal connectivity is concerned.

From an organizational perspective, ASM fully supports the project and covers any costs associated with running the network. The CDC (Center of Disease Control) makes use of ClinMicroNet to advise microbiologists of matters of concern. A recent example was a posting on the first report of Vancomycin-resistant *S. Aureus* (VRSA) on 3 July 2002, which met with an almost immediate response from members. The CDC also queries ClinMicroNet members on matters of policy and practice, an effective means of polling an influential sector of the Clinical Microbiology community.

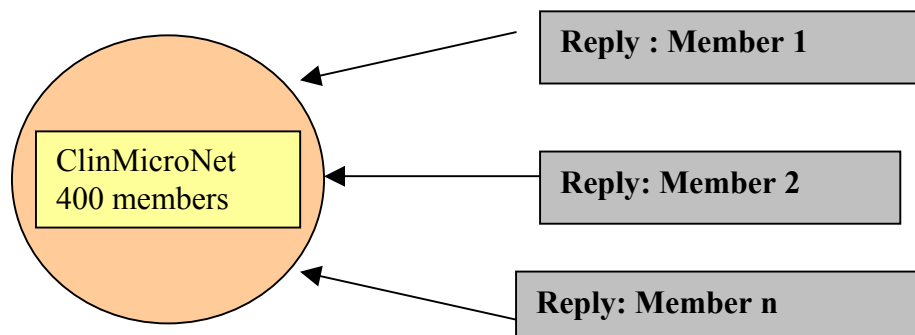
There is a win-win situation for those involved. Passive members benefit from a steady flow of information. Active members from the opportunity to collectively discuss approaches, resolve issues and generate knowledge, as well as build stronger ties with other active members. The CDC and ASM support the building of a stronger scientific community, which in turn makes their role clearer and more rewarding.

II The nature of communication – analysis of message flow

One to Many

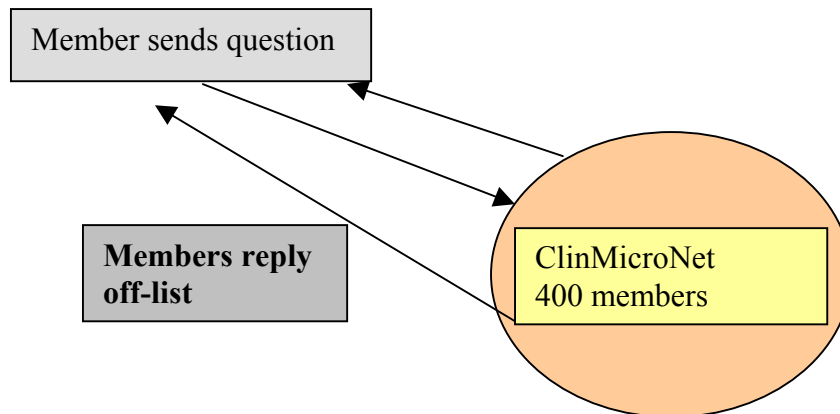


Many to Many

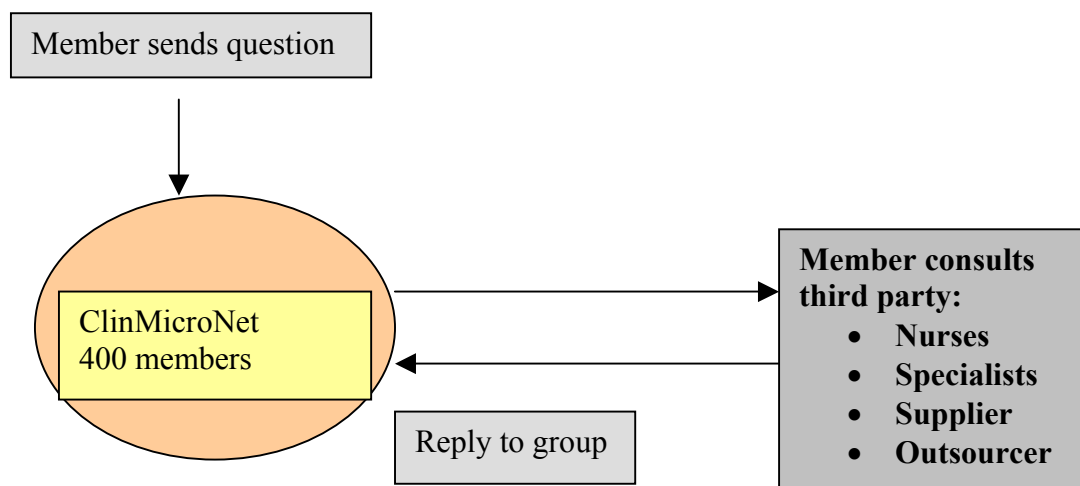


³ Hampton, K; B. Wellman "Long Distance Community in the Network Society: Contact and Support Beyond Netville." American Behavioral Scientist: Sage Publications Inc., Nov. 2001, Vol.45, No. 3, Page 477-495

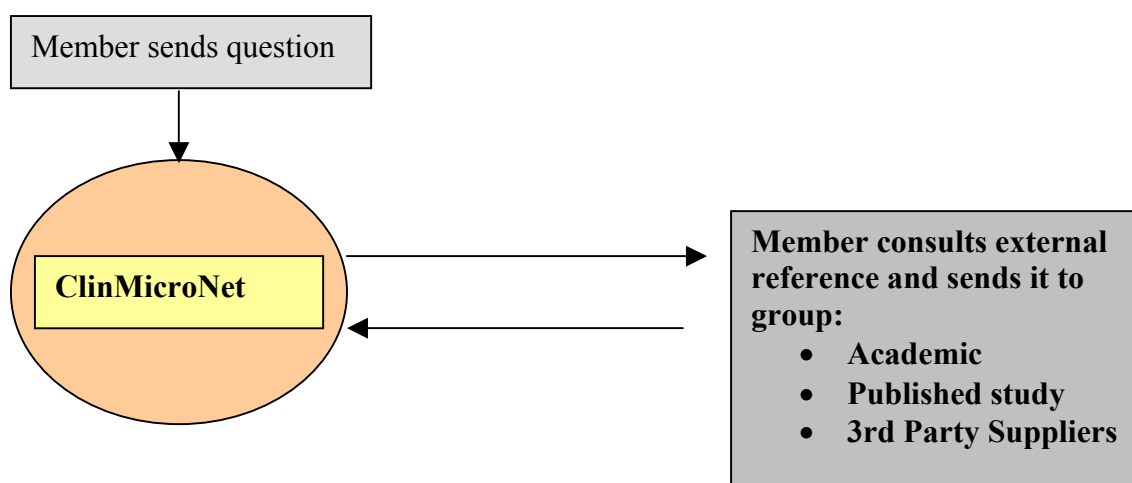
Many to One



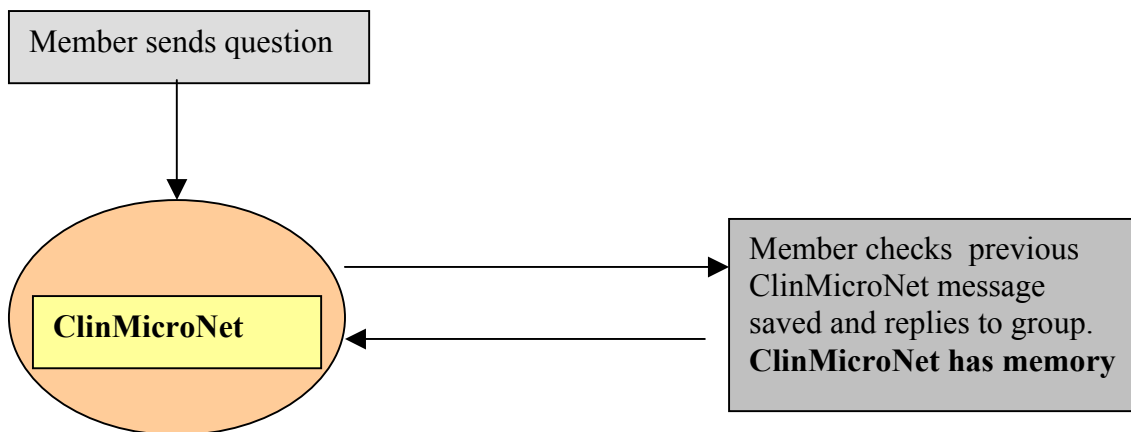
Network Extends to Third Parties



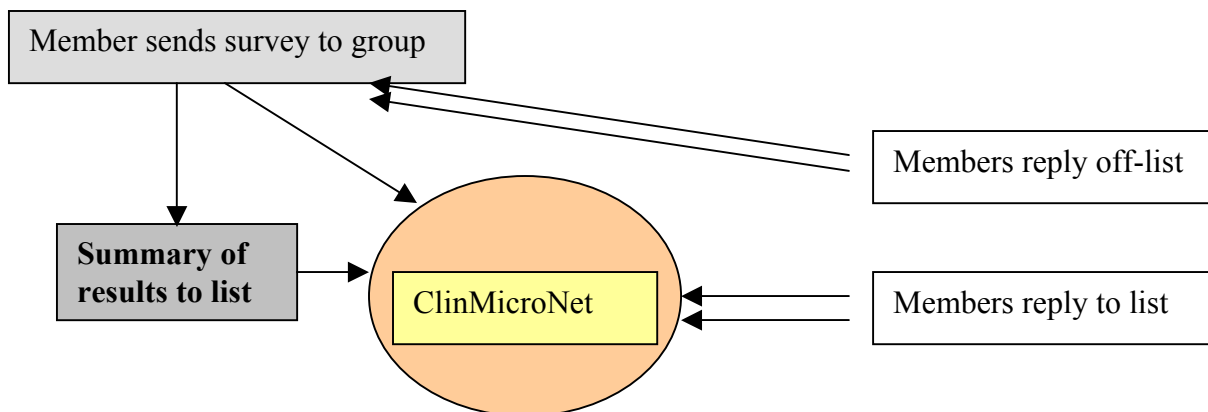
Network Extends to External Knowledge Sources



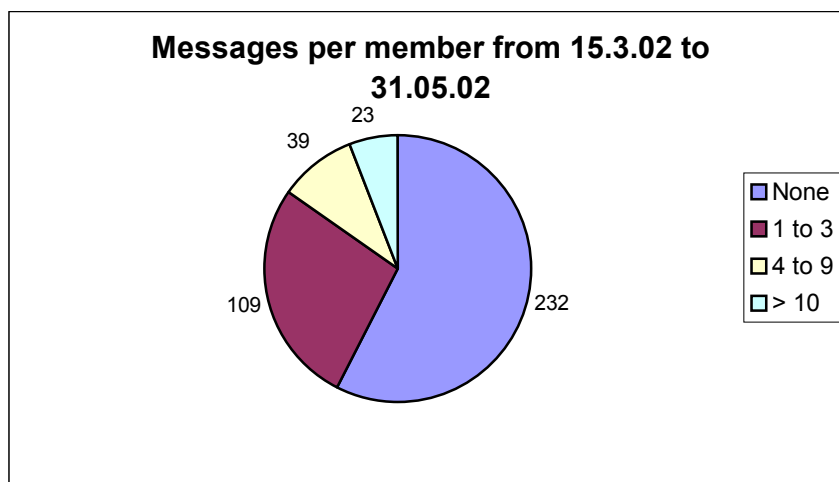
Network Extends to Historical Knowledge



Surveying Members regarding policies and practice

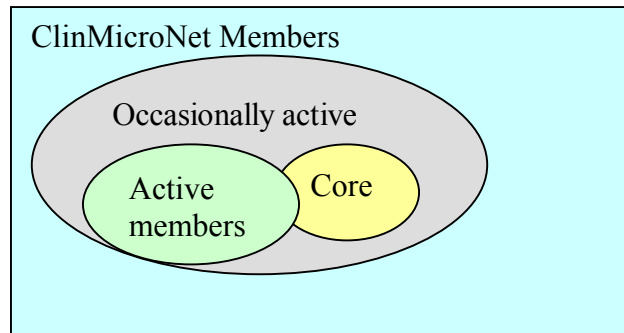


Some messages generate additional questions leading to wider discussions or the generation of broader knowledge related to a theme. The practice of surveying members on particular practices or policies is also quite common. This often leads to an increased number of messages being posted to the list, although some members reply off-list.



Source: Observation of ClinMicroNet messages (Total 404 members)
Graph shows the number of members at each level of participation defined.

This graph indicates the existence of a core group of very active members and a second group of active members, illustrated as follows:



As at 15 May a core group of 20 members was defined, being those members who had intervened at least 10 times between 15 March and 15 May 2002. Although the study period was extended to the end of May, this core group was defined as relevant for the whole period.

Out of a total of 774 messages posted, this group contributed 323 messages, or 41.7%. This includes 65 or 40.3% of the original questions/notifications. Only three members contributed more than 20 messages during the period. This core group of 20 represents just 5% of the total membership, or approximately 12% of the 171 members who were active in the research period.

Five groups can be defined within the network in relation to member activity:

Core members (≥ 10 messages)

Active members (5 to 9 messages) – possibly aspiring to core

Occasionally active

Passive members (silent readers)

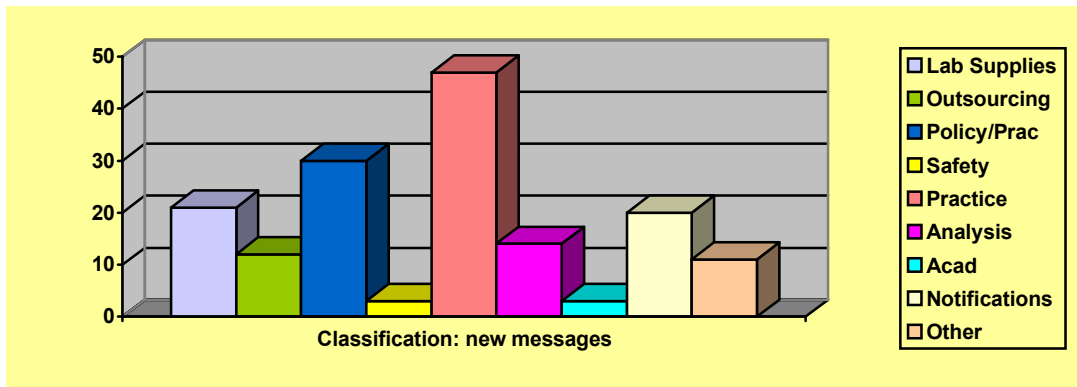
Recognized experts (professional standing)

In reality the Core Group is made up of a combination of experts and active participants. Active participation must be valued by the group for true core group status. A possible measure of this is individual publication records. Another consideration is the nature of responses to questions raised. Occasionally the intervention of a particular member is requested, presumably for their knowledge in the field. In a PhD level community it may be difficult to define “expert”, given that all members have published research.

What type of questions

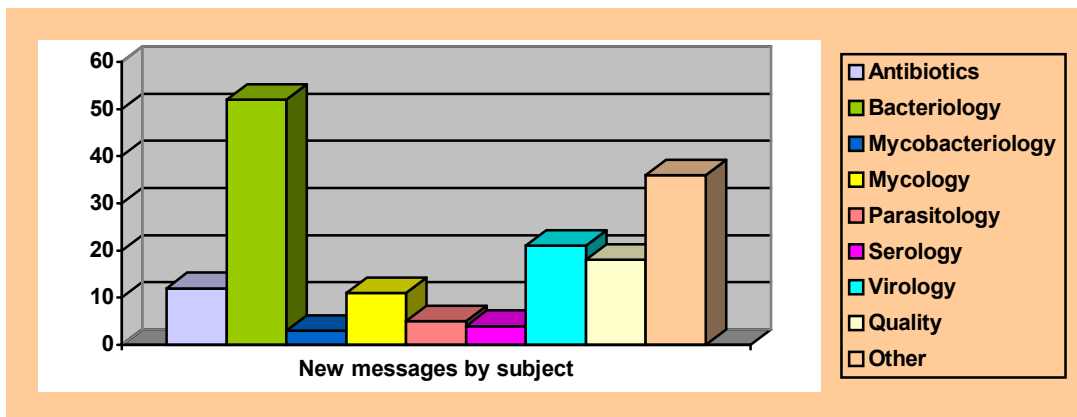
In analyzing the types of messages sent to the list two classification systems were used. Messages were classified by the nature of the question: whether it dealt with lab practice, lab policy, safety, administrative matters, etc.

Some groups overlap, and some messages could fall into more than one group.

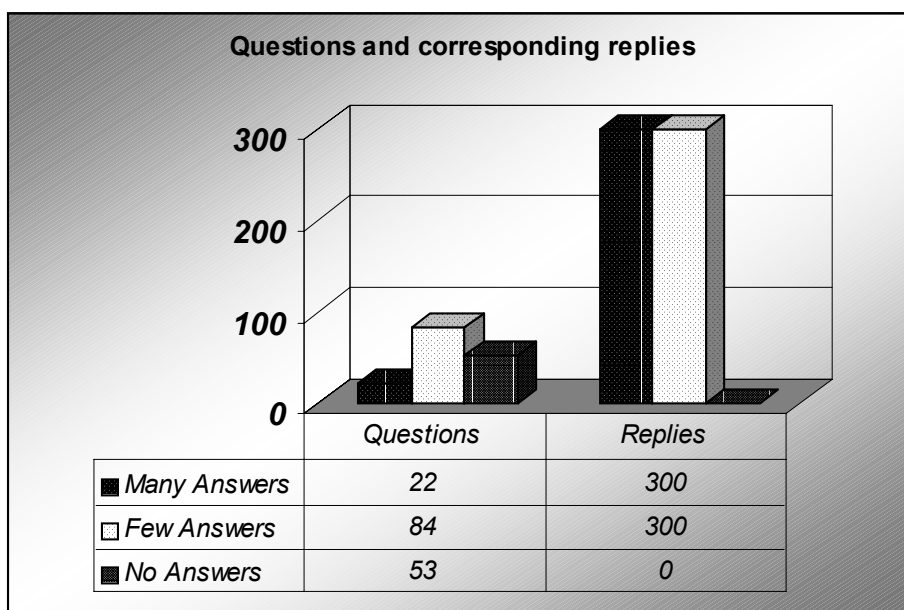


Clinical Microbiologists are generally specialized in one or two fields, so a second classification system was used to detect the existence of sub-groups:

Antibiotics, Bacteriology, Mycobacteriology (tuberculosis), Mycology (fungi), Parasitology, Serology, Virology, Quality and Other (includes general notifications, job opportunities and other matters).



A few messages generate majority of traffic



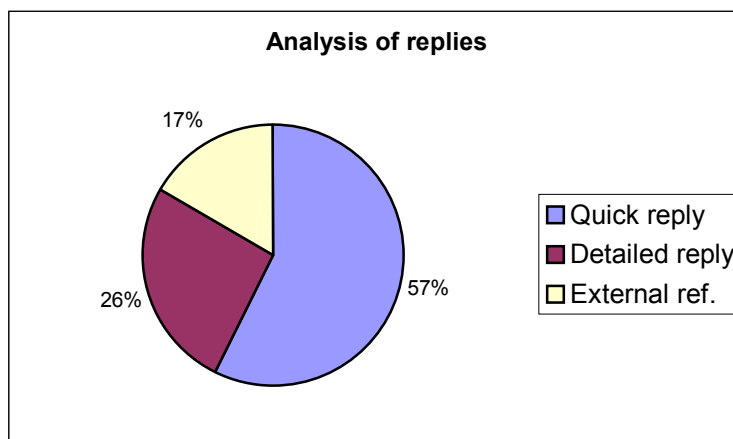
Analysis of data for the entire period confirms that of the 161 new subject lines identified, just 22 subjects produced over 300 replies, or approximately 50% of the replies in the period. Notifications, no responses and reply direct instructions totaled 53 messages, with the remaining 86 messages generating the other 50% of replies with between 1 and 7 responses.

E-mails were sent regarding ten of the messages with no responses to check if replies had been received off-list. Information was received on seven of the questions: six never received a reply and the other received one reply. The total number of questions without any response in the study period represented 10% of new subject lines.

Nature of replies

Messages were coded firstly as questions, answers or notifications, with answers classified as quick, detailed or containing an external reference. This classification system has two key objectives: distinguish between the relative value of answers, both in terms of the information provided and the time required to provide the answer, and secondly, identify the nature of knowledge being exchanged.

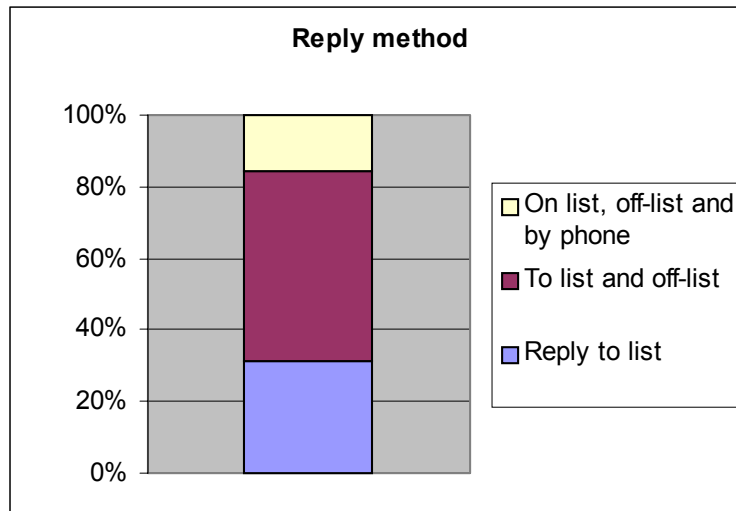
Some questions require a simple response – confirmation or negation of a particular practice, for example (Type 1 – simple/practice). Other questions are more involved and a response requires more time to develop and respond adequately. (Type 2 – detailed/experience) The third type of response identified involves providing an external reference. This may be reference to a particular article, information on a service provider, or referral to an expert in the particular matter in question. (Type 3 – external reference). Type 2 replies generally involve the transfer of tacit knowledge to explicit knowledge, where the member describes personal experience with particular practices. Type 1 replies may also do so, but the reply is brief. Type 3 replies usually involve explicit knowledge in the form of published articles, or contact information for third-party suppliers.



The number of replies sent to a particular question is not a useful parameter to measure the importance of the question. Firstly, replies can vary considerably in the value of their content. One good reply may be sufficient for some questions. When 20 replies are received on one question, the incremental value of the last 10 replies may be limited.

How replies are sent

Whilst most communication can be expected to take place on the list, observation of messages indicated that some responses were made off-list or by phone. This was investigated in the survey, with the following findings:



Those who replied off-list or by phone were all members of ClinMicroNet for some years (joining between 1995 and 2000), whereas all recent members (2001-2002) replied to the list. Logically the longer one is a member, the more likely they are to develop stronger ties with other members.

Three of the six members who stated that they sometimes reply by phone are very active participants in the network, indicating that closer ties tend to exist between the most active members.

These two observations lend support to Hypothesis 1, which is tested against other data.

Hypothesis 1

Members who have strong off-list networks with other ClinMicroNet members have been members for longer and tend to be more active.

Whilst all respondents confirmed some contact with other members of ClinMicroNet beyond the list, only half provided figures to test this hypothesis. Nevertheless, the figures shown in table below support the hypothesis that the members who have a larger off-list network of contacts have been members for longer and participate more actively, suggesting that network membership encourages networking.

Contacts reported	Members identified	Membership 1995-2000	Participation level (Average: 2.4)*	Membership 1995-1998
10 or more	10 of 16	10 of 10	2.0	6 of 10
25 or more	5 of 16	5 of 5	1.8	4 of 5

* Based on survey parameters: 1 = Very Active (Weekly), 2 = Active (Monthly), 3 = Occasional participation.

Social network

There is evidence of a level of familiarity between the more active IDG participants. Several factors contribute to this social bond: the maturity of the network; the existence of conferences attended by many members and the existence of a core group, who, through their active participation, fuel discussion and keep the flow of questions coming.

Confirmation was found in the member survey, where 94% of the respondents confirmed their attendance at either the ASM (American Society of Microbiology) or ICAAC conferences. Furthermore, prior to the ASM conference in May 2002, two or three notifications were posted to the list regarding meetings for ClinMicroNet members

at the conference, including the annual ClinMicroNet box lunch⁴. Whilst the conference was taking place, communication on the list stopped almost completely. One member outside of the US, perhaps unaware of the conference dates, sent a test message to the list, believing that they had a technical problem having not received any messages in the preceding days.

Database for knowledge management

The majority of members surveyed save messages for future reference. Although a database now exists where previous messages can be searched, most members prefer to save specific messages on their own computer. Both active and less active members save messages. The wide range of messages currently saved (5 to 3000) makes it difficult to identify any patterns between different member groups, but does provide evidence that the information exchanged is highly valued. Only one third of respondents had used the database, even though it has an effective search function and threaded messages that improves on the list based structure.

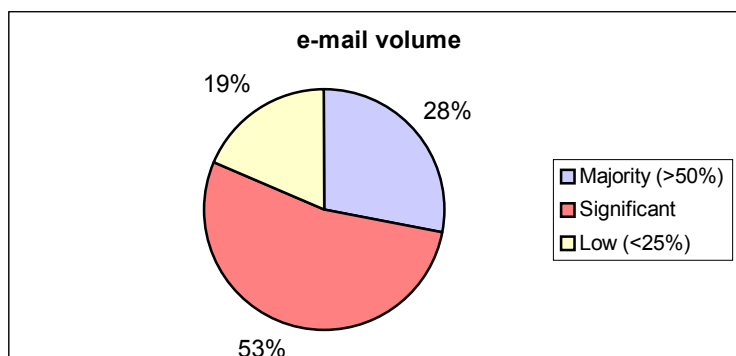
Complementary to existing resources

There are many existing scientific resources available to Clinical Microbiologists. On the understanding that ClinMicroNet complemented other resources a series of questions were included in the survey. Widespread use of the CDC web site, ASM web site and Medline were reported, with all respondents using at least one of these sources and 79% using all three. Medline was used most widely, generally on a weekly basis, whilst reported use of the other sites was predominantly weekly to monthly. All respondents attend conferences, with all but one attending ASM and/or ICAAC in the United States. Analysis of queries sent to ClinMicroNet suggests that members do not generally use the network to find information generally available elsewhere, at least not without looking first.

III What is the user perception of ClinMicroNet?

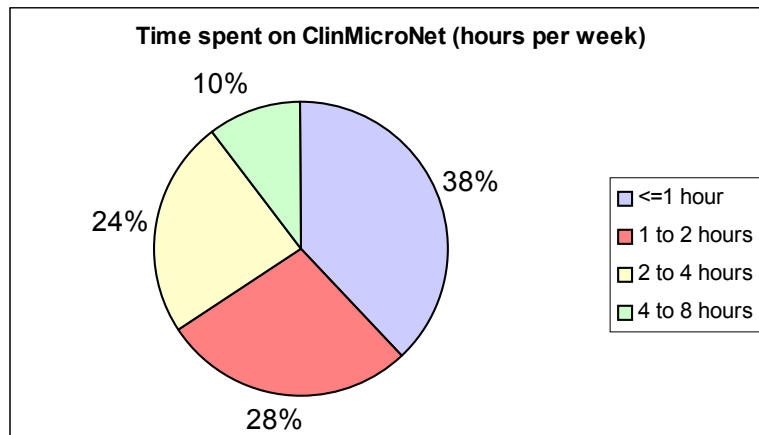
Several key findings emerge from the Member Survey. A summary of results is included in Appendix 2.

Reported share of e-mail volume that comes from ClinMicroNet



⁴ I started the ClinMicroNet meetings at ASM because it is always good to get folks together and meet each other. This killed two birds with one stone, it was the catalyst that tripled the attendance at the annual Division C meeting. Prior to inviting ClinMicroNet members to the meeting to join each other for the lunch, attendance at this meeting was usually between 40-80 people. Now it is well over 150-200. (e-mail from Dr.Michael Miller dated 3 July 2002)

Too many messages on a daily or weekly basis may be counterproductive to the aims of the list, causing clutter and frustration for members. Less than 25% of members surveyed filter messages on arrival, but over 40% delete messages when busy.



Surveyed members dedicate considerable time to ClinMicroNet. Whilst more than half reported spending two hours or less, the receipt of 50 messages per week and filing of many messages for future reference represents a constant time management issue.

Survey data show that members strongly identify with ClinMicroNet as a professional knowledge resource. Of all the variables rated by members, this scored highest at 1.3 on a scale of 1 to 5. Interestingly, members did not value ClinMicroNet as a forum for identifying with their profession. Nor was support of the ASM considered especially important. Keeping up to date and receiving early warnings of emerging problems are two clear advantages of being connected, as the 1.8 average score indicates for both.

The type of information exchanged is considered in detail below in the context of tacit and explicit knowledge. Sharing experiences, expert opinions and matters relating to lab practice were the three variables most highly valued.

The three list characteristics identified were all highly rated: the speed of replies (1.9), multiple replies (1.7) and the exchange of experiences/practices (1.5).

IV What type of knowledge is transferred?

What type of questions and discussion are most valued by members?

Hypothesis 2

The sharing of tacit knowledge is more highly valued than explicit knowledge, which can be obtained from alternative sources.

The evidence used to support this hypothesis is two fold. Firstly, a high percentage of messages focus on laboratory practice and personal lab experience, based on the analysis of communication over the ten week study period. Secondly, the data obtained from the member survey identifies characteristics of ClinMicroNet which are highly valued by members, allowing the relative importance of distinct variables to be measured.

The breakdown of subjects can be classified as follows:

Type of Message	No.	% total	Classification
Practice and Analysis (47 + 14)	61	37%	Tacit/experience
Policy/Practice and Safety (30 + 3)	33	21%	Tacit & Explicit
Lab supplies & Outsourcing (22 + 12)	34	21%	Explicit
Notifications, Academic & Other (20+3+11)	34	21%	Information/explicit

The predominantly practical focus of ClinMicroNet questions underscores the importance of tacit knowledge and individual experience.

The member survey confirms the importance of tacit knowledge and experience as the factors most highly valued where:

Most important characteristics of ClinMicroNet

Presence of established figures (experience)

Sharing experiences (transfer of tacit knowledge)

Most important messages/topics

Expert opinions (experience)

Lab practice (practical issues)

Average valuation

1.8 (on scale of 1 to 5)

1.9

1.5

1.8

How knowledge is created

Ikujiro Nonaka, in his studies on knowledge management in Japanese companies, stresses the importance of looking outside the organization for contrasting approaches, sharing that information within the organization, which is then used to develop new approaches (or products).

ClinMicroNet works across organizations. Its members are professionals interested in working together to learn, compare and share experiences, looking outside their organizations. The problems they face collectively as a professional group serve as a further motivation for co-operation across organizations and borders. Undoubtedly members are influenced by the information exchanged and reconsider their own laboratory practices and policies in light of discussion on ClinMicroNet.⁵

If, as Nonaka writes, *making personal knowledge available to others is the central activity of the knowledge-creating company*⁶, it follows that ClinMicroNet can be defined as a knowledge-sharing network and possibly as a knowledge-creating network.⁷ As members document their personal experience of using particular procedures and tests, they begin to transfer valuable tacit knowledge. On occasions the network acts as a debating hall for defining best practices, although the work involved in true best practice definition is much more involved and necessarily occurs beyond the network. The possibility to draw on the personal experience of many other expert microbiologists is identified as one of the major benefits of belonging to ClinMicroNet.

Observation of list communication confirms that the vast majority of questions receive a reply within 24 hours, with the first reply arriving within the hour more than 50% of the time. This mixture of sharing personal experience and rapid replies has generated

⁵ For a small, trusted, and essential group in this lab, I explained the issue of confidentiality and then use copies of occasional factual ClinMicroNet e-mail answers to questions that will be helpful with the implementation of a new process. Being able to put the information to work within our own organization is the main reason to participate. (Posting of ClinMicroNet member on sharing information with others (02/22/02).)

⁶ Nonaka, I. (1991). "The Knowledge-Creating Company". *Harvard Business Review* (No. 69, November-December, Pag. 96-104).

⁷ Survey indicates that ClinMicroNet is most highly valued as Professional Knowledge Resource (Average 1.3 on scale of 1 to 5)

significant value to members, both those who are active and others whose presence on the list allows them to benefit from the knowledge generated.

Using the tacit-explicit quadrant, different examples of knowledge creation can be identified in ClinMicroNet.

Application	Explicit	Tacit
Origin		
Explicit	Combination (Processes/Systems)	Internalization (Routines – Skills)
Tacit	Externalization (Concepts/Strategies)	Socialization (Values – Attitudes)

Source: Nonaka & Takeouchi (1995)

Tacit to Tacit – the transfer of tacit knowledge takes place when one works in close proximity with another, learning from how they work. One example of tacit to tacit exchange in ClinMicroNet occurs with the interpretation of images. Members look at the image and make their own assessment. An expert in the field sends a reply to the list giving an opinion based on their experience. Individual members can look at the image again and learn through the expert's eyes, increasing their knowledge in the process.

Off-list communication and socialization linked to ClinMicroNet may also further the transfer of tacit knowledge, although this cannot be verified.

Explicit to Explicit – the combination of different information within an area to create a report. During the study period a number of surveys were conducted on laboratory practice/procedures. This information was gathered and collated into a report, which was then sent to the list for the benefit of all members.

Tacit to Explicit – articulating tacit knowledge regarding specific lab practices, experience using particular lab supplies, or the interpretation of information related to specific cases. The process of putting practices, impressions and experience into words in response to a specific question is potentially valuable to all ClinMicroNet members.

Explicit to Tacit – by actively reading ClinMicroNet messages, members absorb explicit information which forms part of their body of knowledge. The majority of members surveyed save many messages on their computer for future reference, and undoubtedly internalize much of the information received on an on-going basis.

Nonaka argues that the existence of each of these four processes within a company leads to a spiral of knowledge. As ClinMicroNet is a network of professionals working in different organizations, all members benefit from the shared knowledge. On occasions the administrator will provide additional references to feed discussion but there is no systematic attempt to maximize the value of information exchanged. The members are the main actors and ultimately their input is what makes the network successful. It is the voluntary nature of ClinMicroNet that ensures its success. Members participate through their commitment to the project and occasional participants gain and add value to the network as an audience.

V Impact of ClinMicroNet beyond its members: the anthrax example

One of the primary concerns amongst members is confidentiality. The network is closed and there is an on-going fear that information exchanged freely about tests, lab supplies and procedures will end up in the hands of marketing staff in the

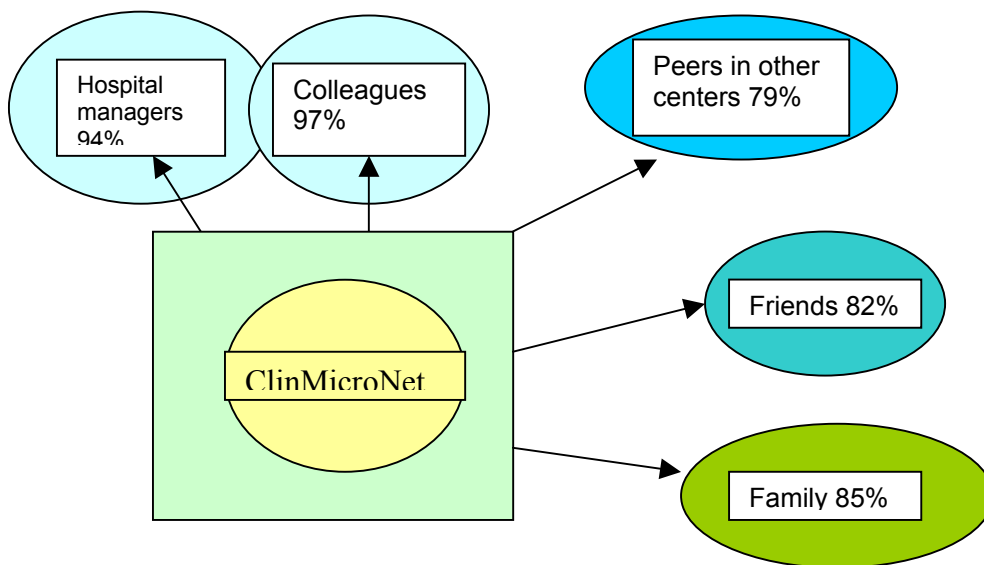
pharmaceutical companies. This might on the surface suggest that an attempt to keep information private will limit the impact of the network.

Nevertheless, members make use of the knowledge exchanged to review their own practices and policies, and it follows that some of the information is discussed beyond the network.

This issue was considered in the context of the highly publicized anthrax scares to measure the potential impact of the network in the wider community. As reflected in the survey results, the strong public interest also existed within ClinMicroNet, as all respondents either participated in discussions or followed the information. A search of the ClinMicroNet database indicates that 337 messages on Anthrax related issues were posted between 3 October 2001 and 7 March 2002 time and the overall message flow was 29% above the long-term (1999-2002) 200 message average.

Circles of Influence

Perhaps more significantly, the active discussion within the network flowed into the workplace, and beyond. Any friend of a microbiologist wanted to know about anthrax. Constant media attention brought the matter into the family living room. The fear of widespread bio-terrorism made anthrax readiness a top priority for all medical centers, especially hospitals, meaning a need to review protocols, ensure that staff were informed of all relevant procedures and equipped to deal with the risk.



As reflected in the survey data, information flowed. Undoubtedly the anthrax scare is a special case, but it does demonstrate the circles of influence when interest is high.

Areas requiring further research:

The threshold: how many messages are too many messages?

An analysis of message flow over the past three years shows ClinMicroNet has a surprisingly constant activity on a month to month basis. Clearly there are peaks as some questions generate a large number of replies, but 300 to 400 messages per month can be expected. (Details in Appendix 4)

At what point would members leave ClinMicroNet if the volume of messages increased significantly? There is evidence to suggest that active members already do a good deal to limit the volume of messages in the following ways:

Once a question is resolved, there is little further discussion or comment.

A majority of members surveyed indicated that as well as replying to the list, they also reply either off-list or by phone. No figures could be gathered with respect to the volume of off-list communication. This practice reduces the overall volume of messages, whilst reducing the information available to the group. There may be many motives for communicating off-list or by phone: the response is of limited interest to the group; the response is specifically directed to the member who raised the question; the respondent wishes to include a personal note; the response is to a survey and should not be sent to the list. Phone calls suggest a more personal relationship, or perhaps are used when it is easier to explain a procedure or practice than write it down.

The majority of members surveyed reported spending two hours or less a week on ClinMicroNet. A boost to the popularity of ClinMicroNet with more members and messages might lead to an information overload, undermining the objective of sharing knowledge. Balance would appear to be critical. A popular method of dealing with information overload in busy work periods is to delete messages, but deleting is also time consuming.

Passive members

The biggest challenge is to further explore what can't be observed. The motivation of passive members. For many members, it may be enough to receive information, learning from others, contrasting practices with those that they use, occasionally responding to specific questions or raising a problem. With more than 40% of members participating in a ten week period, ClinMicroNet is very successful and the debate on the motivation for members to participate is not considered in detail. Whether individuals are motivated by an interest in making contacts, a desire to further their professional reputation, or an interest in promoting better work practices and understanding in their field is difficult to determine⁸. The practical nature of the information exchanged would tend to suggest the later as the overriding motivation for membership, supported by the responses in the survey.

The only justification for receiving an average of 10 messages per day over a long period of time is a strong interest in the subject. Members must be invited to join the list, but are free to leave when it no longer serves their needs. The user survey provides some evidence on passive members, as 8 out of 33 members surveyed did not participate during the study period and the majority (20 out of 33) defined their participation level as occasional (less than monthly). An analysis of this group shows that they save messages, maintain social contacts beyond the list, and value the same attributes as more active members. They are avid readers who follow the flow of messages with a similar level of interest to their more active colleagues.

US focus and US working hours

Given the concentration of members in the US (88%), it is not surprising that the vast majority of active participants are based in the US. Most traffic occurs during the US working day (15:00 to 1:00 CET). The quick response to some questions suggests that the ClinMicroNet community is more useful to those working in this time zone, especially if looking to resolve questions quickly.

⁸ Uwe Matzat discusses these three models for understanding individual motivation in his thesis on Academic IDGs: the contact model (based on Becker's theory of social interaction), the reputation model (Lindenberg theory of social production functions) and the reciprocity model (Thorn and Connolly)

The survey indicated a fairly neutral position of most members with regards to the importance of participants from beyond the US. The small number of members outside the US makes it difficult to get sufficient empirical information to analysis differences between North Americans (US/Canada) and other members. Participation of non North American members (8% of members but only 2.5% of messages) is much lower than that of their North American counterparts.

Conclusion

Empirical evidence analyzed in this study makes it clear that ClinMicroNet is a dynamic forum. It has a clear focus, strong core group, broad based active membership and it meets the information needs of its members by providing them with a space to exchange views and work together to further their knowledge.

Is ClinMicroNet a special case, or does it represent a clearly established model that others can learn from? All networks have their own character, but the structure behind the group can be replicated.

It works firstly as an internet discussion group, but also as a social network, extending its influence beyond the virtual, bringing members together at conferences and creating a reciprocal exchange of information amongst all parties to create more knowledge. The process of knowledge creation makes membership much more valuable. The practical focus responds to a need clearly identified by members, as they learn from the experience of one another in a dynamic environment, where microbial resistance can make standard practices redundant and new challenges emerge as others are met.

Membership by invitation only, and you must qualify by demonstrating a high level of knowledge in the field. This limited access allows the network to grow organically, maintain a balance and avoid the risks of overloading the structure. Quality not quantity seems to be the rule. Most members are the sole representative of their hospital. This makes a relatively small group potentially very powerful, as important messages extend far more widely if the membership is dispersed across many hospitals and centers.

The rules exist to make life easier, to keep things simple, to avoid potential problems or conflicts of interest. Much more important than rules is the active support of the list administrator who founded the network and has guided its evolution.

Looking outside the organization is not new to the scientific community, which has always had its conferences, academic journals and associations. ClinMicroNet complements these existing resources by offering something which the others cannot provide – a permanent forum to discuss practical issues, lab procedures, resolve doubts on difficult cases and work collectively for the benefit of the ClinMicroNet community in the first instance, and through the use of information, influence procedures in the workplace.

This underlying bias towards sharing experiences, information that is not always documented, and contrasting approaches keeps the network alive. An active network invites discussion, best practice development and allows a stronger community to emerge. So long as a balance is maintained, the network can go from strength to strength as members remain active, and the knowledge spiral continues.

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Appendices

Appendix 1 Working Environment for Clinical Microbiologists

Setting the scene:

A brief description of the role of Clinical Microbiologists within the health system and the challenges that they face in their work provides the context for the IDG and the rationale for sharing information.

Clinical Microbiologists are responsible for researching, analyzing and controlling the existence and behavior of microbes. They provide the first line of defense for microbial resistance, food borne illness and bio-terrorist attacks. They serve patients through the detection of infectious diseases. Through infection control they prevent healthcare associated infections.

A growing concern amongst clinical microbiologists is the detection and control of antimicrobial resistance, a problem that has multiplied in recent years as the use of antibiotics has become increasingly widespread.

Some of the key problems facing clinical microbiologists were summarized by Lance Petersen, a ClinMicroNet member, in an address given in November 2001 at an ASM (American Society of Microbiology) branch conference in Philadelphia:

- Empiric therapy becoming more difficult due to drug resistance – more testing
- Need for laboratories to recognize new pathogens
- Support for healthcare infection control
- Support for detection of bioterrorism
- Support for detection of food safety failures

L.R. Peterson & al. Clin Infect. Dis, 32:605 2001.

Laboratory issues include:

- Shift from fee for service to fee for patient
- Restructuring/consolidation of services into larger groups
- Intense economic pressure for cost reduction as first priority/driven by cost center (administrative) concept.

Laboratory changes:

- Centralization
- Moving “off-campus”
- Restructuring with fewer dedicated professionals
- A combination of services with service reduction “on site”.

Motivation for communication:

Faced with increasing complexity and pressure on resources, there is a clear motivation for Clinical Microbiologists to share information and experiences, in an effort to improve practices and resolve problems. Moreover, in highly specialized fields, doubts about practices can only be resolved through discussion with other experts working in the same area in different hospitals.

Appendix 2 Member Survey and summary of results

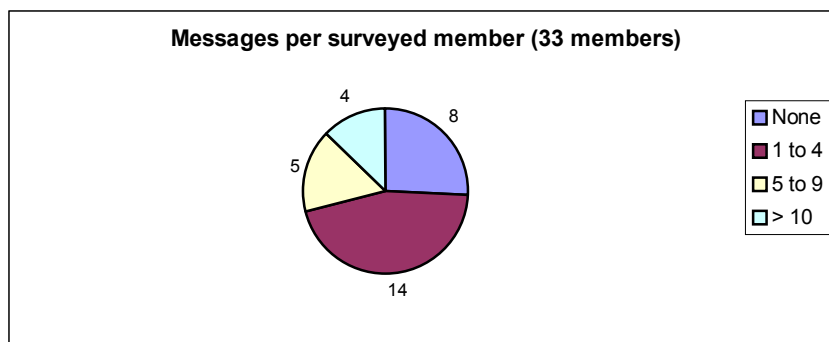
Characteristics of ClinMicroNet Members Survey Group.

The survey group was randomly selected by taking every sixth member from the membership list. The group is biased towards more active members, as shown in the graph below of the observed activity level of the sample population during the research timeframe.

Respondents identified their level of activity as follows:

Very Active	(Participate weekly)	6 out of 33	(18%)
Active	(Participate monthly)	7 out of 33	(21%)
Occasional	(Participate occasionally)	20 out of 33	(61%)

A check to verify each individual's activity level during the study period showed that of the 6 members who indicated they were very active, all but one were very active during the study period. Amongst the active group, two members were very active (11 messages) and the other 5 members sent an average of 4.2 messages. The largest group was those who said they participated occasionally. With the exception of two individuals (9 and 6 messages respectively during the study period) the activity level was in line with expectations (8 inactive and average of 2.5 messages for others).



Member questionnaire on the use and value of ClinMicroNet

Introduction

This questionnaire forms part of a research project on ClinMicroNet and its study as a closed professional knowledge network. The research is being completed under the Information and Knowledge Society Doctoral Program led by Manuel Castells (University of California, Berkeley) and offered by the Universitat Oberta de Catalunya, Barcelona.

The questionnaire is being sent to one in six members of ClinMicroNet, selected randomly. It should take less than 15 minutes to complete. Your cooperation in providing this information is appreciated.

Instructions for completion:

Please mark your reply with an "x" immediately to the right of the answer selected (preferably in red). For example, if asked to rate importance of a specific characteristic on a scale of 1(most) to 5 (least):

Information on lab policy 1 2~~x~~ 3 4 5
For replies to Yes / No questions Yes ~~x~~ / No or Yes / No ~~x~~

Summary of Results:

Total of 33 completed questionnaires received from expanded sample group (response rate of 1 in 2.5 approx.)

Questionnaire

Name:

Workplace: **82% US 18% Non US**

Position:

Workplace details : (Please indicate)

Hospital Laboratory **70%** External Laboratory **9%** University **18%**
Other **3%**

Details:

If hospital, indicate size: < 500 beds **33%** 500 – 1000 beds **50%** > 1000 beds **17%**

Is it a teaching hospital? Yes / No **24 teaching hospitals (73%)**

Does the lab perform other analytical procedures (hematology, biochemistry, etc.) or only microbiology? **Varies (Roughly 50:50)**

Membership

When did you join ClinMicroNet?

a)2001-02 **10%** b)1999- 2000 **40%** c)1997 – 98 **28%** d)1995-96 **22%**

How did you learn about the network?

a)Personal introduction **100%** b)Information on ASM website c)Other

If other, please indicate:

If a) Personal introduction: (where/how was contact made?)

i)conference **3%** ii)professional meeting **32%** iii)telephone **19.5%** iv)e-mail **26%** v)other **19.5%**

Roughly 50:50 split between in-person and virtual (telephone/e-mail), given that 3 of 6 in the "Other" category were referred by colleagues at work.

Level of Participation

How would you describe your participation in ClinMicroNet?

As contributor: Very Active (weekly) **18%** Active (monthly) **21%**
Occasional **61%** Non contributor (to date)

As message reader: Very Active (read > 70%) **58%** Active (read > 50%) **24%**
Selective (read < 50%) **12%** Very selective (read < 30%) **3%**

Of all the e-mail messages you receive, what percentage come from ClinMicroNet?

Majority (> 50%) **28%** Significant volume (25 to 50%) **53%** Less than 25% **19%**

When you reply to messages, mark which of the following methods you have used:

Reply to list **31%** Reply to list and off-list **53%** Reply to list, off-list and by phone call **16%** Other (please indicate)

Rate the importance of the following factors in membership of ClinMicroNet:

(1 = most / 5 = least) Note: values can be repeated

Professional knowledge resource	176%	2	3	4	5
Identification with professional group	115%	2 30%	3 27%	4	5
Keeping up to date	139%	2 42%	3	4	5

Early warning of new issues	145%	2 39%	3	4	5
Resolving work problems	136%	2 21%	3 24%	4	5

What importance do you give to the following characteristics of ClinMicroNet?

(1 = most / 5 = least)

Presence of established figures in field	1 45%	2 36%	3	4	5
Large number of labs/hospitals involved	1 33%	2 42%	3	4	5
Presence of microbiologists outside USA	1	2 24%	3 33%	4 30%	5
Support and implication of ASM in project	1	2 21%	3 24%	4 27%	5 24%
Opportunity to share experiences	1 39%	2 36%	3	4	5

How do you value the following types of messages? (content)

(1 = most / 5 = least)

Information about lab policy	1 30%	2 48%	3	4	5
Information about lab practice	1 45%	2 39%	3	4	5
Discussion of particular cases	1 15%	2 55%	3 15%	4	5
Notifications from CDC/List coordinator	1	2 39%	3 30%	4	5
Notifications about job opportunities	1	2	3 35%	4 23%	5 23%
References to studies/published research	1 18%	2 52%	3 21%	4	5
Exchanges on use of materials/equipment	1 27%	2 36%	3 27%	4	5
Exchanges on external service providers	1	2 25%	3 40%	4 19%	5
Opinions of recognized experts	1 67%	2 21%	3	4	5

How important are the following characteristics of ClinMicroNet?

(1 = most / 5 = least)

The speed of replies	1 36%	2 39%	3	4	5
Multiple replies to one question	1 52%	2 36%	3	4	5
Exchange of experience/practices	1 64%	2 24%	3	4	5

Managing message flow

Do you have permanent access to e-mail at your desk? Yes **94%** / No **6%**

Do you receive e-mail: immediately / on demand (using function key) **21%**

How much time do you dedicate to ClinMicroNet per week? **Range from 15 minutes to 8 hours (38% 1 hour or less; 28% 1 to 2 hours; 24% 2 to 4 hours; 10% 4 to 8 hours)**

What practices do you employ in managing ClinMicroNet messages?

Do you filter messages? Yes **25%** / No **75%**

Do you delete unread messages when busy? Yes **55%** / No **45%**

Do you read messages: at specific time on arrival

depends on workload depends on subject depends on sender

Do you save specific messages for future reference? Yes **91%** / No **9%**

If yes, how many messages do you have saved approximately? **5 to 3000**

Do you remove your name from list when you go on holiday? Yes **15%** / No

Use of message archive

Have you made use of the message archive which is now available?

Yes **33%** / No

If yes: Use regularly For specific searches For missed messages

How important is a message archive by subject? **1 2 3 4 5**

Will you continue to save specific messages in your own files? **Yes / No**

ClinMicroNet as complementary resource

Which of the following resources do you use?

		Frequency (daily/weekly/monthly)		
CDC web site	Yes 91% / No	Daily	Weekly	Monthly
ASM web sites	Yes 88% / No	Daily	Weekly	Monthly
Medline searches	Yes 94% / No	Daily	Weekly	Monthly
Other (please indicate)				

Are you a member of any other ASM lists? Yes **27%** / No

Please indicate(x): **MICROEDU PCEDU**

Others: ...**Division C**.....

Professional exchanges

Which of the following conferences do you attend?: **All attend some conferences**

	Annually	Sometimes
American Society of Microbiology Annual Conference	49%	42%
ICAAC Annual Conference (North America)	18%	67%
European Society of Microbiology Annual Conference		
Other North American conferences		
Other international conferences		

Contact with Members of ClinMicroNet beyond the list Y / N **94%** How many?

Range from 1 to 100 (members)

At conferences or professional meetings Yes **94%** / No

Off-list, through e-mail unrelated to list discussion Yes **94%** / No

Collaboration in multi-center research projects Yes **48%** / No

Other professional contacts: reviewing articles, etc. Yes **61%** / No

Friendships/ social network Yes **65%** / No

Specific Events – Threat of bioterrorism

During the period of anthrax scares ClinMicroNet was particularly active, with many messages exchanged on the subject.

Did you participate in any of these exchanges? Yes **39%** / No

Did you follow the messages on this subject? Yes **97%** / No

Did you subsequently discuss the Anthrax risk outside of the network?

- with senior management? Yes **94%** / No

- with colleagues in workplace? Yes **100%** / No

- with peers in other centers? Yes **81%** / No

- with friends? Yes **84%** / No

- with family? Yes **87%** / No

Use of Internet/ Other e-mail lists

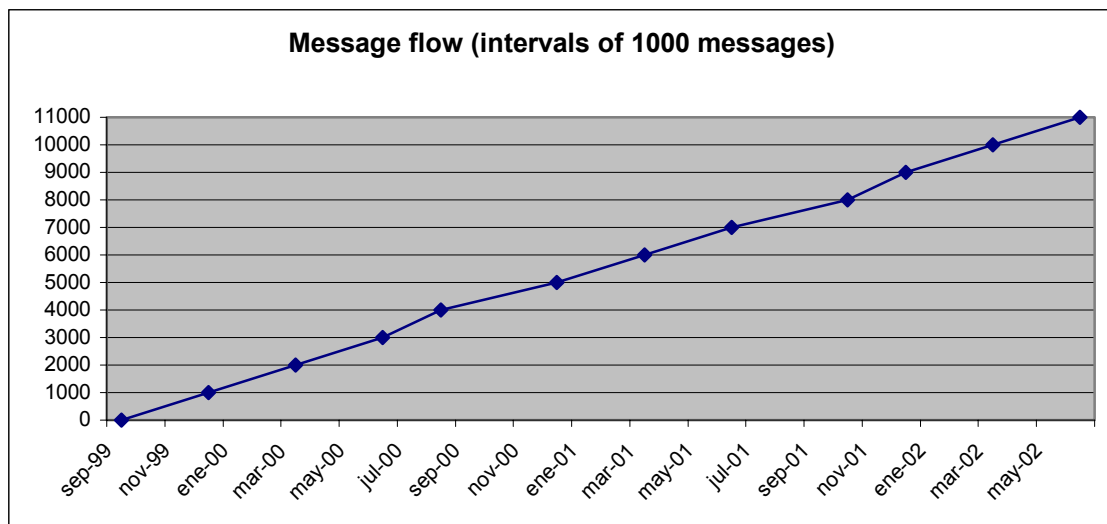
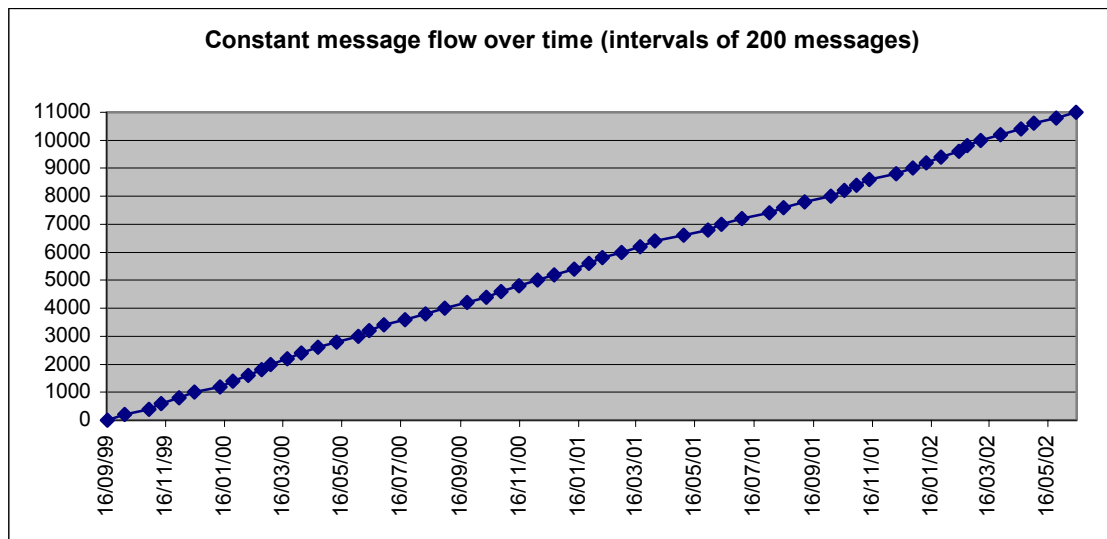
Do you sometimes access ClinMicroNet outside of workplace? Yes **30%** / No

Are you a member of any other e-mail lists (other than ASM)? Yes **70%** / No

Are you actively involved in any internet sites? Yes **45%** / No

Appendix 3 Analysis of long-term message flow on ClinMicroNet

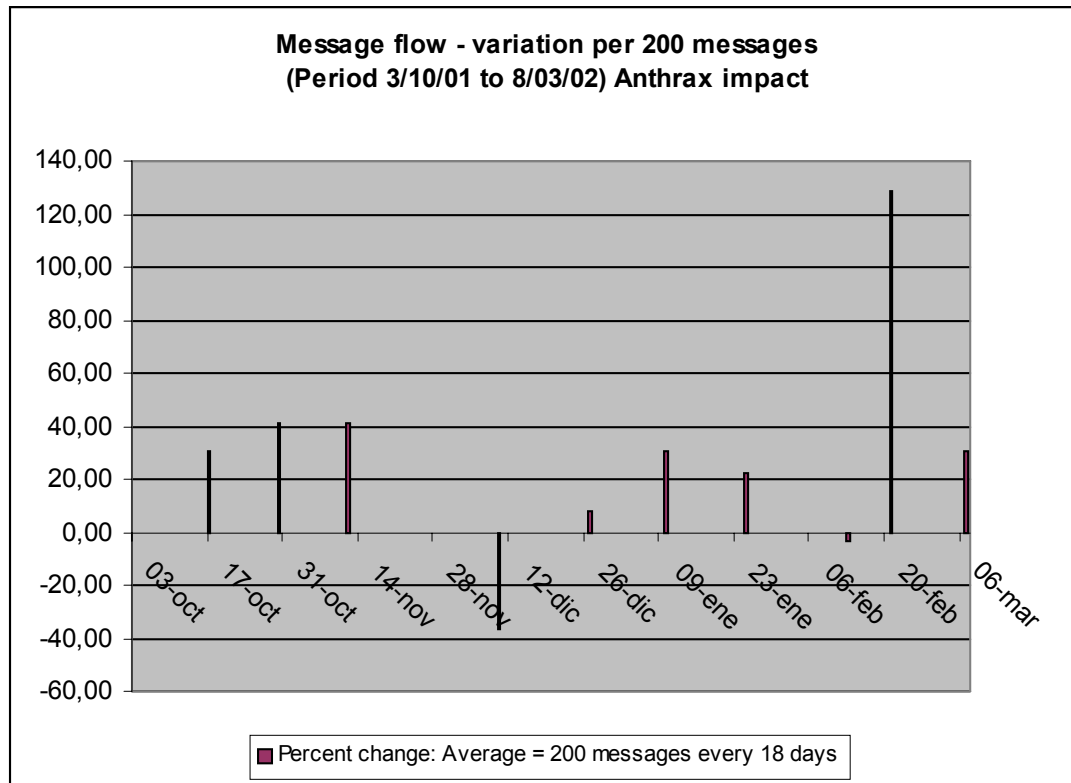
Volume of messages (Sept 1999- June 2002)



Comments

The above graphs provide evidence of the maturity of ClinMicroNet and the continuous flow of messages exchanged by members over time. Message volume is cumulative, showing a steady climb throughout the period. The distance between the dots can be used as an indicator of more intense periods of activity (higher message flow shown when dots are closer together).

Statistics have been taken from the message database which dates back to September 1999.



In this respect, the October 2001 to February 2002 period shows a higher than average message flow, undoubtedly linked to the anthrax cases. A search of the ClinMicroNet database indicates that 337 messages on Anthrax related issues were posted during this time and message flow was above the long-term (1999-2002) 200 message average in 8 of the 10 intervals shown in the graph.

What the graph shows:

The percent variation is calculated against the average time for 200 messages to be posted to ClinMicroNet, based on message flow between September 1999 and June 2002.

A positive percentage indicates a higher than average flow of messages (e.g. 13 days = 40% higher than average of 18.3 days). Conversely, a negative figure indicates a longer period to accumulate 200 messages, or 65% of the average message flow.

Note that variations due to weekends or public holidays have not been accounted for. Messages on anthrax may help to explain the overall increase in messages during this period, but do not explain the peak between 13 -21 February, as only two anthrax messages were posted in this period. The explanation is partly found in a number of requests for information from the list coordinator which received a large number of responses from members.

Appendix 4 ClinMicroNet general policy and etiquette - Information provided to new members–

General Policy

There are liability issues that are associated with the management of listserv's, and therefore the ASM has established guidelines for users of the system. They are as follows:

1. The ASM accepts no responsibility for the opinions and information posted by users other than the ASM.
2. Do not post any defamatory, abusive, profane, threatening, offensive, anticompetitive or illegal materials. The ASM does not condone and will not be responsible for any such materials or resulting liability, including antitrust liability. In no event will ASM be liable for any special, indirect or consequential damages or any damages whatsoever resulting from loss of use, data or profits, arising out of or in connection with the use or performance of any information posted on this site.
3. Do not post any information protected by copyright without the permission of the copyright owner. By sending information via the ASM listserv, the sending party warrants and represents that it owns the copyright to such information, or has received permission from the person or entity who owns the copyright to such information. By posting information to the ASM listserv the posting party grants the ASM and users of the ASM listserv the non-exclusive right and license to display, copy, publish, distribute, transmit, print, and use such information. Subject to the grant of this license, the posting party retains any other rights that the party may have to such information.
4. The ASM does not actively monitor the site for inappropriate postings and does not on its own undertake editorial control of postings. In particular do not post commercial messages, such as promotional announcements, advertising, product-related press releases, or other commercial use. However, in the event that any inappropriate posting is brought to the ASM's attention, the ASM will take all appropriate action.
5. Federal anti-trust laws make it illegal for competitors or potential competitors to fix prices in anyway. This prohibition applies to discussion of specific prices, costs, or rate structures among ASM members. The financial and criminal penalties for violating this law are very serious.
6. The ASM reserves the right to terminate access to any user who does not abide by these guidelines.
7. Members are not allowed to send attachments to the list

Listserv Etiquette

Discussion group participants should pay careful attention to the general policy guidelines. Some general tips to enhance the quality and readership of discussion groups are provided as follows:

1. All postings should be signed with the subscriber's name and e-mail address. This is called a "signature" or "tag line" and helps identify you to the people who read your message. If the posting is an announcement, include contact information, such as phone, fax and E-mail address.
2. Subscribers should be willing to make their names known. Subscribers will not be allowed to conceal their names from being seen on a list, and may not post anonymous messages.
3. Postings to the groups should contain questions, comments or information that is relevant to the group topic and of interest to the entire group. If you want to question the opinions and information presented by others, please do not challenge or attack these people by "flaming". If you have a differing opinion, please support your opinion or comments and use them to express yourselves in a professional manner. Subscribers can learn and benefit from qualified responses to situations or questions.
4. When replying to a message, include the parts of the previous message which are pertinent to your point or comment. When possible, delete the header information from the previous message, or any other non-essential text. This will make the message more readable for others and help reduce the time it takes for those with dial-up connections to retrieve their mail.
5. Non-relevant topic messages, personal and test messages should be sent directly to the administrative e-mail address, not via the discussion group.
6. Do not write postings in all capital letters. This is considered "screaming", and is not appropriate on the Internet. To emphasize or draw attention to text, enclose it in asterisks (*).
7. If inappropriate messages occur/and guidelines are not followed, subscribers may want to complain about the posting. They should not reply with their complaints to the entire discussion group. This distracts the group from the main discussion topic to a focus on network etiquette. Subscribers should reply with complaints and protests directly to the moderator/manager.