Model Formulation ■

Understanding the Normalization of Telemedicine Services through Qualitative Evaluation

CARL MAY, PHD, ROBERT HARRISON, MSC, TRACY FINCH, PHD, ANNE MACFARLANE, PHD, FRANCES MAIR, MD, PAUL WALLACE, MD, for the Telemedicine Adoption Study Group

Abstract **Objective:** Qualitative studies can help us understand the "successes" and "failures" of telemedicine to *normalize* within clinical service provision. This report presents the development of a robust conceptual model of normalization processes in the implementation and development of telemedicine services.

Design: Retrospective and cumulative analysis of longitudinal qualitative data from three studies was undertaken between 1997 and 2002. Observation and semistructured interviews produced a substantial body of data relating to approximately 582 discrete data collection episodes. Data were analyzed separately in each of three studies. Cumulative analysis was conducted by constant comparison.

Results: (1) *Implementation* of telemedicine services depends on a positive link with a (local or national) policy level sponsor. (2) *Adoption* of telemedicine systems in service depends on successful structural integration so that development of organizational structures takes place. (3) *Translation* of telemedicine technologies into clinical practice depends on the enrollment of cohesive, cooperative groups. (4) *Stabilization* of telemedicine systems in practice depends on integration at the level of professional knowledge and practice, where clinicians are able to accommodate telemedicine through the development of new procedures and protocols.

Conclusion: A rationalized linear diffusion model of "telehealthcare" is inadequate in assessing the potential for normalization, and the political, organizational, and "ownership" problems that govern the process of development, implementation, and normalization need to be accounted for. This report presents a model for assessing the potential for successful implementation of telehealthcare services. This model defines the requirements for the successful normalization of telemedicine systems in clinical practice.

■ **J Am Med Inform Assoc.** 2003;10:596–604. DOI 10.1197/jamia.M1145.

Recent years have seen increased interest in the use of telecommunications in clinical practice and a proliferation of reports on services and systems employed by interested clinicians and other health care providers.[1,2] There is now a large body of research and development literature that presents summative results of evaluations of a mass of trial and demonstration projects. Whatever the results presented in this body of work, telemedicine has largely failed to systematically penetrate the "marketplace" for civil health care provision in the United Kingdom and United States.[3,4] More than this, as a field of practice, it seems to be mainly characterized by trial, demonstration, or experimental services that do not endure beyond the life of specific research and development funding initiatives. Only in teleradiology has there been any evidence of normalization—a move toward the routinized embedding of telemedicine in everyday clinical practice.

Explaining the failure of telemedicine to normalize is important to clinical and policy proponents of these technologies who see them offering solutions to some key problems in

Affiliations of the authors: Royal Free and University College Medical School, London, England (RH, PW); University of Newcastle upon Tyne, Newcastle upon Tyne, England (CM, TF); National University of Ireland, Galway, Republic of Ireland (AM); University of Liverpool, Liverpool, England (FM).

This paper was presented orally at two Royal Society of Medicine telehealthcare meetings, one in the spring of 2002, and the other in January of 2003. A summary abstract of the paper was published in the *Telemed03* abstracts book, distributed on the conference CD, and published in the *Journal of Telemedicine and Telehealthcare*.

The studies reported in this paper have been funded by the following organizations: National Health Service Executive North West Region R&D Directorate: (grant RDO/12/20); Manchester West Primary Care Group; UK Department of Health: (grants ICT/032 ICT/167, ICT367); the NHS R&D HTA programme; and the UK Economic and Social Research Council (grant L218 25 2067). The authors thank these agencies for their financial support of the research and they gratefully acknowledge the contribution of Theresa Atkinson, Helen Doyle, and Nicola Shaw to the studies on which the current paper is based. Maggie Mort made a substantial intellectual and practical contribution to studies TM1 and TM2, which the authors acknowledge. The authors thank Dr. Bonnie Kaplan and anonymous reviewers of this article for their detailed critical comments, which greatly improved the final manuscript.

Correspondence and reprints: Carl May, PhD, Centre for Health Services Research, University of Newcastle upon Tyne, 21 Claremont Place, Newcastle upon Tyne, NE2 4AA, United Kingdom; e-mail: <c.r.may@ncl.ac.uk>.

Received for publication: 04/10/02; accepted for publication: 06/30/03.

improving access to health care and equitably distributing specialist clinical expertise. The growing body of summative data about individual telemedicine interventions does not help us to explain this in a compelling way. This body of literature tends to present favorable results from specific projects, providing evidence of clinical and cost–effectiveness and high levels of patient satisfaction. Systematic reviews, however, tell a different story, demonstrating frequently methodologically inadequate study designs. Such reviews suggest that there are strong grounds to be skeptical about the quality of data on which assumptions about the utility and efficacy of telemedicine practice are founded.[5–8]

In this article, our objective is to move debates about telemedicine forward. Our central argument is that while there is much summative evidence available about the endpoints of telemedicine evaluations, another important field of inquiry has been neglected. To understand the failure of telemedicine systems to normalize across different applications, we need also to attend qualitatively to the formative processes that characterize them. Understanding these can provide a strong foundation from which to understand *how* and *why* many services fail to endure. Our objective is, therefore, to make the case for a complementary model of telemedicine evaluation that uses qualitative research methods to understand the formative processes through which new systems are designed, developed, implemented, and evaluated by their users. While in other areas of health informatics research the division between formative and summative research is not characterized by *method*, in telemedicine research summative evaluations have tended to be quantitative and formative evaluations qualitative. This neglects the degree to which *process*-oriented studies offer important lessons. To meet this end, in this article we report three ethnographic studies of telemedicine services and evaluations undertaken in the United Kingdom. On the basis of this work, we set out a theoretical model that has face value for predicting the normalization of specific telemedicine interventions.

Background

Because of its promise, telemedicine has captured the attention of clinicians, health care providers, and policy makers, although it is recognized that it presents new kinds of problems in developing, implementing, and managing services.[9] A key problem for proponents of telemedicine has been that the *evidence base* on which its promise is founded is deficient. Systematic reviews of clinical effectiveness,[7] cost–effectiveness,[5] and patient satisfaction[6] have all pointed to the poor quality of existing evidence and argued against basing policy on the results of many small-scale studies characterized by methodologic inadequacy. At the same time, questions about the clinical *safety* of some kinds of telemedicine have yet to be answered.[10] One product of this has been a shift—in the United Kingdom at least—toward the use of randomized controlled trials (RCTs) to establish the clinical efficacy and cost–effectiveness of telemedicine systems.[11,12]

Evaluation is vital. Without high-quality evidence, professional and political support for telemedicine cannot be sustained. But summative evaluation—whether by RCTs or by other means—does not tell the whole story about what is needed to make telemedicine systems and services work. Recent work in other areas of health care shows that outcomes evidence alone will not result in the take up of innovations.[13,14] In the case of telemedicine, the conditions that lead to the *normalization* of new information and communications technologies in clinical practice are not well understood. *Normalization*, rather than *adoption* or *diffusion*, is at issue because it can refer to the take-up or local reinvention of an innovation in highly contextualized settings, rather than at the health care system level. This means that a technology (in this case telemedicine systems) does not have to be widely diffused across the services provided by a particular agency, or even generally adopted. Instead, it becomes one of a number of means by which services can be delivered. Most importantly, it ceases to be a special application and instead becomes one of the normal arms of clinical practice. As Rinde and Balteskard observe,[15] this is precisely the trajectory that teleradiology seems to have followed. The transmission of radiologic images for remote interpretation is now routine.

While there is now a large body of research that has explored the development, implementation, and use of new systems across the general field of health informatics using qualitative sociologic research techniques,[16,17] they have rarely been applied to the field of telemedicine. The paucity of such literature is startling given the implications of telemedicine for the organization and practice of health care delivery. There are some important examples of such work, however. In the United States, Whitten et al.[18,19] have applied them to understanding the diffusion of telemedicine as an innovation in specific settings. In Scotland, a study has explored expectations and the *potential* impact of such systems on health care practice,[20] and, in Norway, Aas[21–23] has explored the ways in which "telehealthcare" is integrated into practice in a specific setting. Lehoux et al.[24,25] have provided a critique of health technology assessment approaches to telemedicine and a finely grained observational analysis of such systems *in use* in Canada. This article, however, is concerned with the broader issue of developing a generalizable account of the conditions in which telemedicine systems can become *normalized* in clinical practice: combining studies of development and implementation, the organization and practice of telemedicine evaluation groups, and the local problems experienced when telemedicine systems are used by clinicians to undertake work with patients. Drawing together the results of our work, therefore, permits us to develop a broad analysis of telemedicine within a specific health care system (the British National Health Service, or NHS). The wider relevance of this work is established by using it to generate a series of propositions that define the normalization process.

Study Groups and Methods

Our analysis draws together the findings of three separate studies (TM1, TM2, and VOP) focusing on telehealthcare systems employed at 11 sites in the United Kingdom. We describe the three studies below, and the study sites are summarized in Table 1. All the studies used qualitative research techniques drawn from a long-standing tradition of interactionist ethnographic research in medical sociology,[26–28] and a more recent tradition of social studies of science and technology.[29,30] Although two of the studies (TM1 and TM2) were sequentially linked, they were aimed at answering different research questions and were undertaken entirely separately from study VOP. Integrative analysis of the three

Table 1 ■ Description of Studies

Study	Site Description	Interaction Type
TM1/001: Telepsychiatry	Real-time link between family practice and hospital department.	Concurrent dyadic interaction: patient and doctor.
TM1/002: Teleinternal medicine	Real-time link between two hospital centers.	Concurrent triadic interaction: patient, resident, consultant physician.
TM1/003 Teledermatology	Store and forward link between family practice and hospital department.	Extended triadic interaction: patient, specialist nurse, consultant physician.
VOP Large multispecialty trial	Real-time link between family practice and hospital department.	Concurrent triadic interaction: patient, family practitioner, consultant physician.
TM2/001 Anonymous	Store and forward link between family practice and hospital department.	Extended triadic interaction: patient, specialist nurse, consultant physician.
TM2/002 Anonymous	Store and forward link between family practice and hospital department.	Extended triadic interaction: patient, family practitioner, consultant physician.
TM2/003 Anonymous	Real-time link between patient's home and two hospital centers.	Concurrent dyadic interaction: patient and specialist nurse.
TM2/004 Anonymous	Real-time link between hospital departments and tertiary referral center.	Concurrent multiprofessional interaction: patient, secondary care clinicians, tertiary care specialists.
TM2/005 Anonymous	Real-time link between hospital department and tertiary referral center.	Concurrent clinical videoconferencing.
TM2/006 Anonymous	Real-time link between patient's home and hospital department.	Concurrent dyadic interaction: patients, hospital-based specialists
TM2/007 Anonymous	Real-time link between family practice and hospital department.	Concurrent triadic interaction: patients, specialist nurses, and physicians.

Note: participants in TM2 were promised anonymity.

studies was undertaken by developing iteratively a series of propositions that were tested, study against study, when coauthors met to review the outcomes of their work. An initial outline model[31] was sketched out, and detailed reanalysis then was undertaken. The latter is reported in this paper.

Study TM1: Formative Process Evaluation of Telehealthcare Interventions in North West England

May et al.[32] conducted a qualitative formative process evaluation of the implementation of three telemedicine services in an English region and was concerned with understanding the professional and organizational dynamics of their implementation and evaluation. Between 1997 and 1999, we examined services providing telepsychiatry, internal medicine, and teledermatology.[32–34] In each case, formal, semistructured, and unstructured interviews were undertaken with key informants (clinicians, technical experts, evaluators, managers, and in psychiatry and dermatology with patients); participant observation was undertaken in clinical and management meetings and other settings; documentary analysis was conducted on archives of service documentation and correspondence, including e-mail archives and log files at individual computer terminals. In each case, data collection followed the service from its inception. Data interpretation (of more than 200 discrete data collection episodes) followed the precepts of *constant comparison*[35] formed through inductive, rather than deductive, analysis.

Study TM2: What Factors Promote or Inhibit the Effective Evaluation of Telehealthcare Interventions?

May et al. undertook an ethnographic study of the evaluation of telemedicine services. The study aimed to identify and explore those factors that promote or inhibit the effective evaluation of telemedicine systems and was specifically concerned with the practices and processes involved in the social construction of reliable knowledge.[36–38] Carl May and colleagues purposively sampled telemedicine evaluations (four randomized controlled trials and three pragmatic "service" evaluations) commencing between the fall of 1999 and summer of 2000. The study group conformed to a maximum variation sampling strategy in which the study groups distinguished by service type ("store and forward" delayed data transmission versus "real-time" interactive video links); by service site (academic versus nonacademic link); and by evaluation type (randomized versus nonrandomized). Maximum variation sampling strategies have proven highly successful in other areas of health services research.[39] The sample was not intended to provide a "representative" sample of telemedicine interventions in any statistical sense but rather to provide a sufficient range of research contexts on which an intensive study of specific cases could be founded. Once again, ethnographic methods were used on around 250 data collection episodes: including 85 key informant interviews times, participant observation at meetings and on other occasions, and the textual analysis of project documentation. In three cases, we followed the project from its inception; in others, data collection was undertaken at various points in the service cycle.

Study VOP: Understanding the Virtual Outreach Trial

Robert Harrison and colleagues undertook a study concerned with understanding the conditions affecting the course and outcomes of a large RCT, built around a new joint medical teleconsultation service developed as an alternative to standard outpatients. Since 1995, a progressive series of telemedicine studies have taken place at the Department of Primary Care and Population Sciences at the Royal Free and University College London Medical School. Following a feasibility and pilot study, a major RCT of joint medical teleconsultations at the primary/secondary health care

interface was conducted between 1998 and 2001.[40–44] In this RCT,[11] 2,105 patients were referred by 134 family practitioners to 20 hospital consultants in six different specialties. The specialties involved were ENT medicine, general medicine, gastroenterology, orthopedics, neurology, and urology. Patients who consented to participate in the RCT were randomized to either a joint teleconsultation or a routine outpatient appointment. While a range of quantitative outcome measures were assessed in the trial, it became apparent that a number of key questions relating to organizational, social, and educational issues should also be addressed and that these would be most appropriately evaluated through qualitative research methods. The qualitative work took place during the course of the main body of the RCT and comprised video recordings of the telemedicine appointments (n = 60), semistructured interviews (n = 69), and focus groups (n = 13 groups) with patients, consultant surgeons and physicians, family practitioners, and administrative personnel who had participated in the RCT. Data were analyzed according to the principles of framework analysis.[45]

The Conditions Needed to Normalize Telehealthcare

The analysis that we present in this section of the article uses the data collected in the three studies described above to understand the conditions that are needed to normalize telehealthcare systems. We define four levels of activity—*implementation*, *adoption*, *translation*, and *stabilization*—where intervention and support are required to ensure the legitimacy and integration of telehealthcare into existing modes of clinical practice. Our approach is to use qualitative data to illustrate the arguments that we present, and to present these arguments—in summative form—as testable propositions.

Linking Practice with Policy: Implementation

Our point of departure is the link between the development of telemedicine systems in practice and the wider policy environment in which they are situated. In the United Kingdom there is a policy impetus supporting the development of telehealthcare at the national level, and it has figured prominently in a number of key policy announcements.[46] However, in practice, development is mainly restricted to relatively small (often short-lived) services formed around networks of enthusiastic policy and clinical champions.

> *VOP/consultant CDW1:* I mean it's a waste of everyone's time—I'm sure there'll be enthusiasts who say oh it's great, and this is wonderful, but it isn't really. I mean it was only useful in my view as a research project. . .wouldn't tell you anything about the real world. I mean in the real world there has to be someone saying to me. . . .
> *Interviewer:* Yes? You were saying as a research project it wouldn't translate into the real world.
> *Consultant:* I mean the time it takes to get me, a patient, and a GP together at one point in time is a tremendous waste of resources, really, and I think the only way is if someone says, OK, this afternoon you're in outpatients—and it's all totally mad—and you give me 12 patients and then it becomes a worthwhile exercise in my view.

Funding for services is problematic too. Indeed, a key problem for service providers and systems manufacturers is the difficulty of linking policy objectives at a national level with service provision at a regional or district level. Policy in the United Kingdom emphasizes the importance of local innovation—a "bottom-up" approach that leads to relatively uncoordinated development. At the same time, modernizing policy runs against the necessity of showing an adequate evidence base for new modes of clinical practice[4] in a health care system where resource allocation is in constant political crisis. For this reason, much telehealthcare development in the United Kingdom actually is resourced through research and development funding streams. This has led to a plethora of *evaluation* studies, often based around randomized controlled trials, with mixed results. We can see an emergent and continuing conflict here between policy streams about *technologic modernization* of services (from which position telemedicine is promoted), and the construction of a solid *evidence base* for clinical practice (from which position telemedicine is inhibited).

> *TM2/1-research manager1-(3):* [. . .] we are being asked, *told*, to set up teledermatology services without any good evidence whatsoever, and our role is to be proactive in this, and if they insist that we do this' round the country, then we should be having research as part of that, so at the end of the year or two years we can say, OK, we've been running a teledermatology service for two years here, and the evidence is that it doesn't stack up, costs, satisfaction, time, whatever.

A key problem for proponents of telehealthcare services has, therefore, been how to link their *modernizing* interests in developing new systems with ways of working with the existing organization of clinical service provision. Experimental systems may be set up in parallel to existing clinical services (this is necessary to conduct an RCT), but integrating "real" telehealthcare services is problematic because of the ways that innovations disturb and destabilize the institutional and professional dynamics of existing organizational structures.

We have seen considerable evidence of this in our work. For example, the very business of organizing and connecting synchronous interactions, both dyadic and triadic, created difficulties. Clinicians found it hard to integrate new and "different" models of practice into their deeply embedded local working structures.[44] Organizing and connecting interactions using these systems had to be more strictly timetabled, and loss of clinical flexibility resulted. The logistic and practical difficulties that stemmed from this clashed with the conventional organization of care and were seen by clinicians as a major barrier to implementing telehealthcare systems, even in parallel services. This was especially evident in study VOP.[44,47] Clinicians perceived that these logistical and practical difficulties posed significant barriers to the implementation and sustainability of this telemedicine application in the health service, particularly around time management. Family doctors taking part in a focus group in VOP exemplified this position:

> VOP/FG1(Focus Group 1)/GP(General Practitioner)
> *GP2:* I think when it was in the trial it was fine because it was a limited amount of consultations, but if it sort of wasn't a trial and there was a lot of them, I wonder how it would affect our. . . .

GP15: Appointments. . .it makes it more difficult then.
GP2: Yeah.
GP15: Absolutely.
GP2: 'Cause it does take up sort of two or three appointment slots.

Where local champions of telehealthcare have possessed sufficient institutional power to insist on the integration of infrastructures into which telehealthcare systems can be effectively situated, then services *do* develop—even though they may be subject to a range of other, complex, local problems. The structural dynamics of the settings into which attempts are made to situate and operationalize telehealthcare services are therefore crucial variables in the normalization process. They form a context in which networks and alliances of interested actors (policy makers, clinical champions, technology manufacturers, and so forth) can form. The formation of these networks reveals that powerful sponsors are vital in defining these systems as appropriate means of delivering care. Sponsors are not necessarily champions of new technologies: indeed, they may actually be skeptical about the benefits that telehealthcare confers, or they may have very limited and local ambitions to solve immediate problems in the short term. Whatever their motives, their capacity to define new systems as an appropriate means of clinical practice and to resource it, is vital. These observations lead us to offer a general proposition about the conditions in which telehealthcare systems come to be implemented, and to argue that the *implementation* of telehealthcare services depends on a positive linkage between a (local or national) policy level sponsor and local champions, so that telehealthcare is defined and resourced as an appropriate means of delivering care, and appropriate infrastructures are developed to hold it in place.

The Structural Legitimation of Telemedicine Service: Adoption and Translation into Practice

Even where a positive linkage exists between policy sponsors and local champions of telehealthcare, the developmental nature of many telehealthcare systems means that their legitimacy as a means of delivering routine clinical care is in doubt. There are two problems here: (1) the intraorganizational and interprofessional politics of service definition and delivery and (2) the definition and establishment of appropriate knowledge and practice. In both TM1 and TM2 we found extensive evidence of intraorganizational contention about the legitimacy of telemedicine as an appropriate mode of delivering services, and the difficulty of building and sustaining networks of actors that can organize services in parallel to existing patterns of services delivery. The legitimacy of telehealthcare is always in doubt at this level, for it is perceived by clinicians as primarily an experimental form of practice, even where it seems to have been put in place as a routine mode of clinical work.

VOP/Consultant CDW2: I have to go to a place I don't normally go, to remember to go at a time when I have other commitments, umm. . . because it's a short burst of activity which cuts across—you know—an empty space. And (. . .) in order to fit it in one has to give and agree to do it at a time, and in one's quality time really 'cause I have quality time, you know, a couple of times a week. I've got an all day time and I've got a half day time which I do all this stuff I do here, and drop that for an hour, go somewhere else, switch mind sets, start all over again, come back, it just doesn't fit one's work. It's really very unsettling.

Underpinning this is a more fundamental problem. All three studies highlighted the difficulties of interpreting experimental knowledge about telehealthcare practice (derived from clinical experiments and trials, as well as the wider evidence base) and that difficulties of translating such knowledge into clinical practice are underestimated by local proponents of these new technologies. Evidence developed according to the normative criteria of health technology assessment is crucial to the legitimacy of telehealthcare systems but is difficult to translate into clinical practice because it relies on formal structures for the production and presentation of knowledge that may be only loosely connected with the practical exigencies of routine clinical work.

The translation of evidential knowledge into clinical practice relies on the stability of the "hardware" itself in mediating between clinicians and patients, but this cannot be assumed. Subtle features of the system may have important and unanticipated consequences for clinical practice. The focus on the "hardware" visible in many reports on telehealthcare services and trials reflects the obvious importance of it "working" in terms of its technical specification. But there is much less evidence of organizational accommodation and the effects of new technology on professional roles in the mass of reports.

For example, in VOP, there was considerable divergence of views between specialists and general practitioners about the most appropriate role for general practitioners in real-time triadic teleconsultations. The nature and extent of general practitioners' involvement was a contentious issue between these professional groups for the duration of the trial and caused considerable tension and dissatisfaction among clinicians.[43]

In TM1, analysis of the transition of telehealthcare projects from "clinical experiment" to "experimental clinic" found that the evidence obtained from earlier RCTs did not translate easily into clinical practice.[34] Moving on from the work of a small group of enthusiasts into a quasiroutine clinical service involved a significant level of investment in *accommodation*. This was not simply around building a technology that works, but actually reengineering the organization of *knowledge* in it, and constructing a service into which it could be practicably incorporated. This led to rapid changes in the division of labor within the service: initially nurses were delegated the task of acting as proxies in interaction with patients, while consultant physicians shifted to remote diagnosis—working from digital photographs.

TM1/Dermatologist03: My perception [of teledermatology] really relates to a couple of issues. First, the clinical accuracy or the ability to make a diagnosis. When we examine a patient, normally there's more to it than simply looking at the rash or the individual lesion. So often palpation and texture play a large part in it, that's one issue. The second issue, which is perhaps more important, is that even if one can make an accurate diagnosis, often that isn't all that the consultation needs to do. A lot of the information that you get from a patient relates to other issues or the actual clinical diagnosis. In other words, the impact that a skin problem might be having on them, for example. So we might have two people who've got what is

> visually an identical-looking rash. One of them might be completely not bothered, but the other person might be devastated. And those sorts of more subtle clues about patients' anxiety and the impact the problem is having on them, I suspect will be a lot more difficult to get with teledermatology.

Nurses' work was held in place by a tightly structured operating policy and a software protocol. But quickly, nurses started doing expert diagnostic work, and clinicians encountered significant problems of interpretation in the clinical data that they were exposed to. So, definitions of the kinds of knowledge that *count* and negotiations about professional roles of activities both stem from activities of organizing telehealthcare into service provision and arise from it.

> *TM1/Nurse01:* I will be taking a [patient's] history. I will be taking the history of what a doctor would ask in a clinic. So this proforma has got name, address, and everything, and then it goes down to lesion, rash, and you just tick which it is, and if it's a rash then you ask when did the rash first appear, does it come and go, is it itchy, does it burn? So you've got all this history to ask them to get as much information out of them as possible.

In this case,[34] organizing the "facts" into the teledermatology service was accomplished by means of software that drove the clinician–patient interaction through a protocol.

> *TM1/Nurse02:* I think the proforma has to give you the opportunity to ask all types of questions. And it's only when you come up against a condition where you know as an experienced nurse you should be asking that, but if it's not on the proforma it's quite easy to be missed. Because I think most of the time I would say [name of nurse] and I would diagnose what it is, have a rough idea of what it is, but there are occasions where you don't have a clue. So you need to be able to put forward to the teledoctor all the possible questions you could have asked that patient that might be relevant.

Our work shows that clinicians systematically underestimated the difficulties that this involves and that localized networks of clinicians and managers systematically overestimated the ease with which these problems can be solved. In TM2, we have seen substantial problems following the failure to grasp the complexity of operational changes that underpin the implementation of telehealthcare systems.

What this means is that the stabilization of telehealthcare systems in practice requires the production of new kinds of ways of working and a recognition that they may complicate, rather than simplify, the delivery of care in the short to medium term. These complications are encountered not simply in the individualized encounter between clinician and patient, but through the range of professional and organizational transactions on which clinical services are founded. Where this agreement does not exist, clinicians and patients seek to "shoehorn" existing models of interaction and treatment management into the much more limited operational spaces permitted by a technological intermediary,[48] leading to mutual dissatisfaction and resistance to the system in play. This problem is apparent in all three of the projects discussed in this article.

Given these considerations, we can offer two further general propositions about the transfer of telehealthcare systems into practice. First, the adoption of telemedicine systems in service depends on successful structural legitimation. Its integration at this level of structural legitimation permits it to be practically incorporated into health care delivery through the development of organizational structures and appropriate professional roles and identities. Second, the translation of telemedicine technologies into clinical practice depends on the enrollment of heterogeneous actors into relatively cohesive, cooperative groups, in which their functional identities are negotiated and established and their powers relatively well defined.

Clinical Practice in Telemedicine: Stabilization

So far, we have pointed to problems and difficulties that proponents of telehealthcare encounter in linking policy and practice and in estimating both the organizational and knowledge-based complexities that arise from implementing telehealthcare interventions. In the specific interaction between clinician and patient, we found a similar amplification of complexity in all three of our studies. At the outset, it is helpful to note that our work encompassed several quite different interactional styles. These are outlined in Figure 1. In dyadic real-time consultations, patients found telemedicine systems unremarkable in practice.[49] All three studies found that clinicians found communication and especially clinical assessment of patients hard to accomplish adequately. For example, in TM1, dermatologists working with an extended triadic consultation style found that they missed the "subtle" knowledge of the patient that derives from physical copresence.

> *TM2/1-consultant1:* It is not as satisfying as seeing patients, there's an awful lot of subtle information you get from a face-to-face consultation that you can't get from a photograph, on the medical side, but also on the psychological side, a feeling about what that patient wants and being able to give them the information they want as well, because you really don't know what information a patient wants, and they may not want to know everything about their condition, and for some things you wouldn't necessarily tell them everything first time round as well, it's quite a difficult thing (. . .). Patients seem to quite appreciate it because there's not a long waiting time, so they get some information quite quickly, but I don't know if the overall satisfaction will be as great as if they had been seen, they may have waited a bit longer and seen somebody, information, and got all the information directly, because they've got a twohanded thing, we're seeing them, we're passing them back to the GP, there's an awful lot of room for [miscommunication].

In study VOP, concurrent triadic communication styles meant that communications skills themselves needed to be reworked, and physicians were concerned about this:

> *VOP/I/Consultant 1:* I find it very difficult because I've learned a skill of dealing with people in the room you know for many years, and I find I can't use this skill on telemedicine. . . . I would be very hesitant to break bad news, ummm, over the TV because if you've got the person in the room you know and, ummm, you can put the hand on the shoulder [and say], "do you want some Kleenex?"

While in TM1, some health professionals refused to use interactive video for concurrent dyadic communication because of the lack of copresence in difficult situations:

> *TM1/Mental Health Nurse2:* If you have someone who is struggling with communication and to talk something

> through, though if they had actually agreed to go through the link then I think you have already got through some of those barriers. The only problem that might come up is if you have a very anxious person and they go into a panic attack—and they're on their own in the room. There would need to be some way of communicating with somebody there and to say, "look, this person needs help, can you get someone to them quickly?" That's something we need to do.

Others found that the "system" systematically interfered with what they saw as "good" clinical practice:

> *TM1/Psychiatrist2:* I found that you have to maintain eye contact in what I think is a slightly artificial way, and that was partly because of the problems with the sound. If you both spoke at the same time the picture froze and, therefore, you couldn't look away and just throw in the odd remark. So I think that makes a slight difference to face-to-face communication. And also I was sitting—I suspect you can probably set this up in another way—but the way we had it the patient was clearly straight in front, and I was sitting straight in front [of each other] and I don't interview people face to face like that. . . .

In all three studies, many clinicians felt that they had to learn a new way of interacting with patients that they asserted compared badly with their normal interaction. Most importantly, they felt that they could not fully empathize with patients and that they could not behave "naturally."[32,50] But, more generally, perceptions of a satisfactory consultation varied by participating professional. The interaction between clinician and patient in telehealthcare is complex.[25,51,52] In TM1, Mort et al.[34] found that in store-and-forward services (extended triads), physicians objected to the loss of what one called "subtle knowledge" about the patient that came from apprehending the "whole person." In synchronous (real-time) interactions—both dyadic and triadic—clinicians found it hard to integrate new and "different" models of practice into their deeply embedded local working structures.[44]

In study VOP, Harrison et al.[50] found that the incomplete reworking and reengineering of professional roles led to specific interactional difficulties derived from the concurrent *triadic* interaction style. These were the most strongly felt by clinicians and involved them having to switch narrative styles *within* the consultation, as they spoke in turn to each other and to patients. In this excerpt from a video recorded teleconsultation, the consultant explains to the patient that he is going to shift his attention from her to the general practitioner:

> *VOP/VR/Consultant 6:* If you wouldn't mind, if I could just turn 'round to your doctor for a moment and we can just discuss in our own language. . .but I promise you I'll get back to you and explain to you what we're talking about.

This switch, from one mode of verbal interaction to another, was perceived to disrupt professional–patient interaction and, moreover, to lead to a sense of alienation or estrangement from what clinicians perceived their conventional interaction styles "normally" delivered. These disruptions stem from the collision of existing "soft" technologies—learned and practiced modes of professional–patient interaction—and new "hard" technologies of practice. It is now well established that clinicians develop consulting styles and ritualized practices that become unspoken and taken-for-granted modes of working, dealing with workflow, and deploying medical knowledge.[53] These styles of managing interactions are deeply sedimented in everyday practice, formed around an intricately constructed set of interactional techniques and communications skills. These are disrupted by apparently alienating technologies and especially by the intervention of proxies. This leads to a further proposition, which is that the *stabilization* of telemedicine systems in practice depends on integration at the level of professional knowledge and practice, where clinicians are able to accommodate telemedicine in their clinical activities through the development of new procedures and protocols.

Predicting the Normalization of Telehealthcare Interventions

Telehealthcare is characterized by frequently experimental developments that seem seldom to last beyond the trial stage. Some do not endure even that far. Those that endure often do so because an original product champion or team carries them into service. Our research suggests that the relatively poor implementation record for telemedicine may be primarily due to a naïve model of development that assumes a linear, rational process in which high-quality research will readily lead to the acceptance of an innovation and its integration into practice.

The development of practical solutions for these problems defines the conditions for success or failure of individual services. But what can we say about the wider development of telemedicine and its prospects for implementation, adoption, and normalization? The principal limitation on the qualitative research techniques that we have used is that they cannot lead to study results that are generalizable in any statistical sense, although against this we can make the counterclaim that apparently generalizable results from outcomes studies may be equally difficult to apply to specific contextual settings. Most importantly, however, qualitative studies do lead to generalizable theoretical constructs.[26,35,54] In relation to the current analysis, these constructs can be expressed as a set of propositions:

- P_1: *Implementation* of telemedicine services depends on a positive link with a (local or national) policy level sponsor, so that telemedicine is defined as an appropriate means of delivering care, and appropriate infrastructures are developed.
- P_2: *Adoption* of telemedicine systems in service depends on successful integration at the level of structural legitimation so that it is supported as, and thus practically incorporated into, health care delivery through the development of organizational structures.
- P_3: *Translation* of telemedicine technologies into clinical practice depends on the enrollment of heterogeneous actors into relatively cohesive, cooperative groups, in which functional identities are negotiated and established *a priori* and powers relatively well defined.
- P_4: *Stabilization* of telemedicine systems in practice depends on integration at the level of professional knowledge and practice, where clinicians are able to accommodate telemedicine in their clinical activities through the development of new procedures and protocols.

These led us to our final formal proposition:

> P_5: The *normalization* of telemedicine as a means of health care delivery (in whatever setting and at whatever level of health care provision) is conditional on $P_1 + P_2 + P_3 + P_4$.

Our combined analysis of data leads us to argue that these propositions have face validity as predictors of the normalization of telehealthcare systems. If conditions $P_1 + P_2 + P_3 + P_4$ are satisfactorily met and continue to be met then P_5 is, and continues to be, their product. The corollary of this is that if P_x is absent, then P_5 cannot be the product of the others—regardless of how successfully they are apparently achieved—and so the intervention can be predicted to fail to normalize. A simple model using such criteria is an important innovation in telemedicine (and may also be applicable to other information and communications technologies), since the success of interventions in this field is typically assumed to stem from *the system working* at a local level and being summatively demonstrated to be *effective* at that level. This also goes some way toward explaining the disparity between the large number of reported successful interventions and the failure of telemedicine—as a means of health care delivery—to systematically penetrate service provision across a number of national contexts.

The propositions presented above form an expression of an inductive grounded theory[26] in the true sense of the term. They indicate the importance of producing a body of knowledge about *process* that constructively interacts with knowledge about *outcomes*. We need to be cautious about them, however. The necessary generality of such propositions means that they cannot form a detailed set of instructions that guarantee success for a particular service or clinical intervention, but rather define the points on an innovation journey that will itself be contextually highly specific (and will thus relate to the particular character of clinical disciplines, professional and organizational settings, and institutional structures).

Conclusion

The work reported here is based on a large scale concerted program of qualitative investigation conducted independently, but in parallel, by two research groups in the United Kingdom. To our knowledge, this program of work is unique. It has focused on the operational conditions in which telehealth care services are designed, developed, evaluated, and implemented. Qualitative studies enable us to understand the dynamics of telehealthcare services and so determine how and why particular outcomes are reached. In this report we have shown how such studies lead to a finely grained understanding of telehealth care practice and form the basis of a set of propositions that can be deployed to explain the "success" and "failure" of particular interventions.

Our work indicates that a highly rationalized linear diffusion model of telehealth care is inadequate in assessing its potential for normalization, and that political, organizational, and "ownership" issues hold sway over the process of development, implementation, and normalization and so need to be accounted for. The three studies described in this article draw into the foreground a set of problems encountered by clinicians and service providers who use telemedicine systems. These are contextualized by the health care system (the British NHS) and by specific patterns of professional organization and practice that stem from this. But while the context is specific, the processes and practices involved seem to be generic to HMOs and large-scale health care systems. Further research is needed to prove the catalytic validity of our explanatory propositions and their predictive power. However, they may be more widely applicable and have value across a range of information and communications technologies.

The central message of our analysis is that complexity exists at four discrete levels in any given telehealthcare context. We have seen proponents of telehealthcare systematically underestimate the complexity of their work, and we have seen services either fail to come to fruition, or fail to normalize when they do, because of this underestimation.

References ■

1. Sanders JH, Bashshur RL. Challenges to the implementation of telemedicine. Telemed J. 1995;1:115–23.
2. Wootton R. Telemedicine: A cautious welcome. BMJ. 1996;313: 1375–6.
3. Pelletier-Fleury N, Lanoe JL, Philippe C, Gagnadoux F, Rakotonanahary D, Fleury B. Economic studies and 'technical' evaluation of telemedicine: the case of telemonitored polysomnography. Health Policy. 1999;49:179–94.
4. May C, Mort M, Mair FS, Williams T. Factors affecting the adoption of telehealthcare technologies in the United Kingdom: the policy context and the problem of evidence. Health Inform J. 2001;7:131–4.
5. Whitten P, Mair F, Haycox A, May C, Williams T, Helmich S. Systematic review of cost effectiveness studies of telehealthcare interventions: economic benefits of new technology are assumed, rather than known. BMJ. 2002;324:1434–7.
6. Williams TL, May CR, Esmail A. Limitations of patient satisfaction studies in telehealthcare: a systematic review of the literature. Telemedicine J e-health. 2002;7:293–316.
7. Hersh WR, Helfand M, Wallace J, et al. Clinical outcomes resulting from telemedicine interventions: a systematic review. BMC Medical Informatics and Decision Making 1[5], (<www.biomedcentral.com/1472-6947/1/5>). Accessed 2001.
8. Mair F, Whitten P. Systematic review of studies of patient satisfaction with telemedicine. BMJ. 2000;320:1517–20.
9. Rigby M. The management and policy challenges of the globalisation effect of informatics and telemedicine. Health Policy. 1999;46:97–103.
10. May C, Mort M, Mair F, Ellis NT, Gask L. Evaluation of new technologies in health care systems: what's the context? Health Inform J. 2000;6:64–8.
11. Wallace P, Haines A, Harrison R, et al. Joint teleconsultations (virtual outreach) versus standard outpatient appointments for patients referred by their general practitioner for a specialist opinion: a randomised trial. Lancet. 2002;359:1961–8.
12. Mair FS, Boland A, Angus RM, et al. A randomized controlled trial of home telecare. J Telemed Telecare. 2002;8(suppl 2):58–60.
13. Ferlie E, Fitzgerald L, Wood M. Getting evidence into clinical practice: an organisational behaviour perspective. J Health Serv Res Pol. 2000;5:96–102.
14. Downie RS, Macnaughton J. Clinical Judgement: Evidence in Practice. Oxford: Open University Press, 2000.
15. Rinde E, Balteskard L. Is there a future for telemedicine? Lancet. 2002;359:1957–8.

16. Kaplan B, Brennan PF, Dowling AF, Friedman CP, Peel V. Toward an informatics research agenda: key people and organizational issues. J Am Medi Inform Assoc. 2001;8:235–41.
17. Kaplan B. Evaluating informatics applications—clinical decision support systems literature review. Int J Med Inform. 2001; 64(1):15–37.
18. Whitten P, Collins B. The diffusion of telemedicine: communicating an innovation. Sci Commun. 1997;19(1):21–40.
19. Whitten P, Davenport Sypher B, Patterson JD. Transcending the technology of telemedicine: an analysis of telemedicine in North Carolina. Health Commun. 2000;12:109–35.
20. Ibbotson T, Reid M, Grant A. The diffusion of telemedicine: theory into practice. J Telemed Telecare. 1998;4:60–2.
21. Aas IHM. A qualitative study of the organizational consequences of telemedicine. J Telemed Telecare. 2001;7:18–26.
22. Aas IHM. Telemedical work and cooperation. J Telemed Telecare. 2001;7:212–8.
23. Aas IHM. Learning in organizations working with telemedicine. J Telemed Telecare. 2002;8:107–11.
24. Lehoux P, Blume S. Technology assessment and the sociopolitics of health technologies. J Health Politics Policy Law. 2000;25: 1083–1120.
25. Lehoux P, Sicotte C, Denis JL, Berg M, Lacroix A. The theory of use behind telemedicine: how compatible with physicians' clinical routines? Soc Sci Med. 2002;54:889–904.
26. Glaser BG, Strauss A. The Discovery of Grounded Theory. Chicago: Aldine, 1967.
27. Strauss A, Fagerhough S, Suczek B, Wiener C. Social organization of medical work. London: Transaction, 1997.
28. Kaplan B. Evaluating informatics applications—some alternative approaches: theory, social interactionism, and call for methodological pluralism. Int J Med Inform. 2001;64(1):39–55.
29. Pinch TJ, Bijker WE. The social construction of facts and artefacts: or how the sociology of science and the sociology of technology might benefit each other. In: Bijker WE, Hughes TP, Pinch TJ (eds). The Social Construction of Technological Systems. Cambridge, MA: MIT Press, 1989, pp 17–50.
30. Pinch T. The social construction of technology: a review. In: Fox R (ed). Technological Change. Amsterdam: Harwood, 1996, pp 17–26.
31. May C, Harrison R, MacFarlane A, Williams TL, Mair F, Wallace P. Why do telemedicine systems fail to normalise as stable models of service delivery. J Telemed Telecare. 2003; In press.
32. May C, Gask L, Atkinson T, Ellis N, Mair F, Esmail A. Resisting and promoting new technologies in clinical practice: the case of telepsychiatry. Soc Sci Med. 2001;52:1889–901.
33. May C, Ellis NT. When protocols fail: technical evaluation, biomedical knowledge, and the social production of 'facts' about a telemedicine clinic. Soc Sci Med. 2001;53:989–1002.
34. Mort M, May CR, Williams T. Remote doctors and absent patients: acting at a distance in telemedicine? Sci Tech Hum Values. 2003;28:274–95.
35. Strauss A. Qualitative Analysis for Social Scientists. Cambridge: Cambridge University Press, 1987.
36. May C, Mort M, Williams TL, Mair FS, Shaw NT. Understanding the evaluation of telemedicine: the play of the social and the technical, and the shifting sands of reliable knowledge. Proceedings: European Symposium on Information and Communication Technologies in Medicine. Rotterdam. 2001.
37. May C, Mort M, Williams T, Mair FS, Gask L. Health technology assessment in its local contexts: studies of telehealthcare. Soc Sci Med. 2003;57:697–710.
38. Williams T, May C, Mair F, Mort M, Gask L. Normative models of health technology assessment and the social production of evidence about telehealthcare. Health Policy. 2003;64: 39–54.
39. Rogers A, Hassell K, Nicolaas G. Demanding patients? Analysing the use of primary care. Buckingham: Open University Press, 2001.
40. Harrison R, Clayton W, Wallace P. Can telemedicine be used to improve communication between primary and secondary care? BMJ. 1996;313:1377–80.
41. Harrison R, Clayton W, Wallace P. A cluster randomised trial using telemedicine at the primary secondary care interface: findings of a pilot study. J Telemed Telecare. 1999;5: 122–30.
42. Snowden S, Harrison R, Wallace P. General practitioner participants in a telemedicine trial: comparisons with their peers. J Telemed Telecare. 2001;7:32–7.
43. McFarlane A, Harrison R, Wallace P. Joint medical teleconsultations: qualitative evaluation. Paper presented at European General Practitioners Research Workshop, Gdansk, Poland, October 2001.
44. McFarlane A, Harrison R, Wallace P. Sociological Implications of Triadic Medical Teleconsultations. York: British Sociological Association, 2001.
45. Murphy E, Dingwall R, Greatbach D, Parker S, Watson P. Qualitative research methods in health technology assessment: a review of the literature. Health Technol Assess. 1998;2(16): 1–276.
46. National Health Service Executive. Information for health: an information strategy for the modern NHS 1998–2001. London: National Health Service Executive, 1998.
47. MacFarlane A, Harrison R, Wallace P. The benefits of a qualitative approach to telemedicine research. J Telemed Telecare. 2002;8(suppl 2):56–7.
48. Fox R. Methods and themes in the history of technology. In: Fox R (ed). Technological Change. Amsterdam: Harwood, 1996, pp 1–16.
49. May C, Ellis NT, Atkinson T, Gask L, Mair FS, Smith C. Psychiatry by videophone: a trial service in North West England. In: Kokol P, Zupan B, Stare J (eds). Medical Informatics Europe 99: Bridges of Knowledge. Amsterdam: IOS Press, 1999, pp 207–10.
50. Harrison R, MacFarlane A, Wallace P. The implementation of telemedicine: problems for research strategies and methodologies. J Telemed Telecare. 2002;8(suppl 2):39–40.
51. Miller EA. Telemedicine and doctor–patient communication: an analytical survey of the literature. J Telemed Telecare. 2001;7(1): 1–17.
52. Aanestad M, Rotnes JS, Edwin B, Buanes T. From operating theatre to operating studio—visualizing surgery in the age of telemedicine. J Telemed Telecare. 2002;8(1):56–60.
53. Waitzkin H. The politics of medical encounters: how doctors and patients deal with social problems. New Haven, CT: Yale University Press, 1991.
54. Oakley A. Experiments in knowing: gender and method in the social sciences. Cambridge: Polity, 2000.