

The technological mediation of the nursing-medical boundary

Aksel Hn Tjora

NTNU, Norwegian University of Science and Technology

Abstract Norwegian medical emergency communication (AMK) centres are staffed by nurses, who administer requests for ambulance services or access to a doctor. The central position of nurses and the fact that they communicate with doctors by telephone and radio, make this a setting where the doctor-nurse relationship is highly visible. A two-year study of AMK centres showed that much of the work of these centres proceeds quite independently of doctors, as nurses function as competent suppliers of advice or 'medical oracles'. The doctor-designed *Index for Medical Emergency Assistance* is deficient as a tool for guiding nurses' decisions, since it fails to take account of the dynamics of real nursing practice, which is based on experiential knowledge, support from colleagues and collective learning. Data on nursing work in the AMK centres suggest that these nurses have more influence and autonomy in the nurse-doctor interaction than most past studies have indicated.

Keywords: Communication, nursing, medicine, technology, emergency centre, boundaries, protocol

Introduction

The way doctors and nurses share work in health care institutions is probably one of the most important determinants of the efficiency of a health care system. Research over the past 40 years suggests that inter-professional relationships are more complex than was once believed. Early work which identified nurses' influence strategies (Rushing 1962) and the subtle dynamics of the 'doctor-nurse game' (Stein 1967), demonstrated that nurses often play a crucial role in shaping medical decisions. Contemporary medical models of work distribution point to a more collaborative decision-making process between nurse and doctor, which allows nurses to exercise more autonomy in making or challenging health care decisions (Wheless

et al. 1989). There is evidence that nurses in some settings perform tasks that closely resemble the medical work of diagnosis and treatment in the early stages of 'processing' the patient (Hughes 1977, 1988). Recent papers by Svensson (1996) and Allen (1997) have examined the overlap in doctors' and nurses' work and questioned whether the boundary between nursing and medicine is a 'negotiated order'. Allen argues that it is difficult to say how far the division of labour between doctors and nurses is negotiated, without further clarifying the concept of negotiation (1997: 516). However, in day-to-day practice, doctors and nurses have to agree working definitions of the boundaries between their areas of responsibility. In this paper it is demonstrated how the use of a new communication medium – the use of telephones or radio-telephones – may, whether as an intended or unintended consequence, impose new ways of defining that boundary.

Doctors have for a long time claimed 'jurisdiction' (Abbott 1988) over certain tasks; in effect, they have asked society to recognise the medical profession's legitimate control of a domain of work. The profession's 'mandate' (Hughes 1958) set up the legal authority for the profession to recruit, train, examine, license and review performance, and established the formal limits of the medical profession's exclusive jurisdiction (Freidson 1994). Hence, along with the right to perform the work as it wishes, the profession claims rights to exclude other workers. This jurisdiction secures doctors' exclusive right to practice medical tasks and it also maintains their super-ordinate relationship to nurses. However, Abbot argues that, because of its extreme formality, the legally-established world of professional jurisdiction is a static world that takes no account of the living complexity of professional life (1988: 64).

Even though nurses have traditionally had little autonomy in the organisation of hospitals, they have had and, still have, considerable autonomy in shaping their particular nursing practice (Singleton and Nail 1984, Ellefsen 1995). They make decisions in such areas as therapeutic questioning, delivering care through verbal and non-verbal actions, explaining treatment in understandable language, observing expression of needs and initiating diet schedules (Singleton and Nail 1984). Similarly, Nelsen found that emergency medical technicians (EMTs), *i.e.* ambulance personnel, in practice performed a more autonomous medical role than is stated in their job descriptions (1997). This accords with Abbott's observation that there 'is a profound contradiction between the two somewhat formal arenas of jurisdictional claims, legal and public, and the informal arena, the workplace' (1988: 66).

Moreover, changes in the organisation and financing of health care in many Western countries may be setting limits on medical autonomy. According to Ole Berg the 'medicracy' is being dissolved from both above and below (1991: 166). Hospital managers must operate within economic and political constraints, which increasingly impinge on professional behaviour, not least under the market-based reforms affecting many European health systems (Coddington and Moore 1987, Alban and Christiansen 1995, Bruce

and Jonsson 1996, Flynn and Williams 1997, Exworthy and Halford 1998). The medical culture has lost some of its character as a strong and individually committed culture of responsibility, to become an employee culture. The medicracy is being dissolved from below by the professionalising projects of nurses and other service personnel, who seek to develop new areas of discretionary judgement and become less willing to defer to doctors' 'instructions'. Specialist nurses, working in areas such as anaesthesia and ITU, have assumed responsibility for highly-technical functions, which are now regarded as nurses' tasks. The professional standardisation of medical practice may also have changed medical practice. Ole Berg (1991) claims that the increasing use of electronic journal systems will take away the professional mystique that remains. Marc Berg (1997) suggests that standardised protocols can be used by third parties to achieve more external control over the health professions. In this paper it is questioned in which sense implementation of technology in medical emergency communication may have significance on the change of roles of health professions. This particular technology may have potential for both dissolving the medicracy and creating opportunities for more inter-professional control. The paper especially examines how innovative technology in medical emergency communication is relevant for nurses' changing role.

Technology in medical emergency communication centres

In Norway, one area of medical services that has been put into the hands of the nurses is the handling of medical emergency telephone (dial 113) calls. In most hospitals, AMK centres (acute medical communication centres) handle requests for medical assistance, both in emergency cases (where an ambulance or ambulance helicopter may be needed) and in routine cases (where access to a primary care doctor is requested). Since 1986 a range of new technologies has been introduced and nurses work with telephone and radio communication systems, as well as an advanced tracking system based on GPS¹, which is used to identify callers' locations and the progress of ambulances.

The organisation of medical emergency communication in Norway has been subject to debate since the early 1970s and a number of different approaches have been considered. In 1990 the Ministry of Social Affairs delivered regulations for the planning, implementation and operation of a national system, based on the so-called 'Hordaland Model', and in 1991 the Health Directorate decided the technical specifications of the service. The system was based on a series of specialised alert centres which would process emergency calls of different kinds and co-ordinate the delivery of services through a closed radio communication network. The use of different emergency telephone numbers for the different sectors was established. These are currently 110 for fire alarm, 112 for police and 113 for acute

medical help. The 113 number is now answered all over the country by AMK centres.

Guidance from the Norwegian Ministry of Health (SHD 1988) states that the medical emergency communication service is intended to serve three objectives. First, *people* in acute situations will be put in contact with professionals capable of handling any case. Secondly, *local medical professionals* will be able to gain access to expertise and resources in the hospital sector. Thirdly, *hospitals* will be able to collaborate more effectively through the more efficient exchange of medical knowledge and patient data. In the 'Regulations on Medical Emergency Service' (SHD 1990) it is stated that the medical emergency service must provide direct access to competent medical assistance for all those who need it. Hence, there is a legal requirement that AMK centres will provide competent medical assistance to the general public, though it is left to the local centres to organise how the service is provided. The term 'competent medical assistance' is used throughout the regulations, but it is also stated that the AMK centres are to be staffed by nurses. While, nursing competence is not mentioned in the regulations, I shall argue that this concept is of central importance to the work in the AMK centres.

The implementation of information and communication technology in the centres appears to have improved efficiency in the handling of ambulance and doctor requests. But it has also changed nurses' inter-professional relationships with doctors. In particular, there are three aspects of the new organisation of work in AMK centres which merit discussion: first, nurses' use of guidelines on emergency medicine; secondly, nurses' organising of the doctor 'on the road'; and thirdly, nurses' involvement in diagnosis.

The term 'technology' is used throughout the paper and requires definition. MacKenzie and Wajcman (1985) distinguish between three layers of meaning of the word. First, there is the level of physical objects or artefacts. Second, 'technology' may refer to activities or processes. Third, 'technology' can refer to what people know as well as what they do, for example the know-how that goes into operating a radio communication device. In this paper I will limit what is meant by 'technology' to the first two layers – the physical objects and activities or processes – not least the processes of using the artefacts. Thus, my usage of 'technology' refers to the technical artefact and the way it is used. It does not include the professional knowledge and know-how that goes into operating such artefacts, as I find it useful in this paper to treat those as separate entities (although it is acknowledged that much know-how could not exist apart from the physical objects).

Constructivist perspectives (see Bijker *et al.* 1987, Bijker and Law 1992 and Law 1991 for constructivist approaches to technology in general and Elston 1997 for such approaches in the medical science domain) are widely used in social studies of technology. For example, the 'social construction of technology' (SCOT) approach has much to offer when it comes to identifying relevant participants in the development of technical artefacts. Much constructivist research is concerned with the processes and inter-

actions that lead to the general acceptance of certain technological designs or scientific laws (facts). As explained by Latour, '[w]e study science in action and not ready-made science or technology; to do so, we either arrive before the facts and machines are black-boxed or we follow the controversies that reopen them' (1987: 258). One important criticism of constructivism has been made by Button, who claims that constructivists pay insufficient attention to the natural language distinctions made by people who work with the technology being studied (1993). However, it might be argued that SCOT researchers do not intend to present a view of technology from the perspective of its users, but rather to describe how users (or groups of users) more or less unconsciously get involved in the socio-technical design of technology. By socio-technical design, I mean the way technical artefacts are re-designed in the light of user evaluation, but also, and not least, how individual and organisational practice are adjusted to make use of new technical artefacts.

In this paper I focus on the situated use of one existing technical artefact, the specific communication solution in AMK centres and examine how the workability of the technology is a practical accomplishment of its users. The actual design of the artefacts is to some degree separated in time and space from the working technology (in the sense of artefacts-in-use) of which they are part. However, from the user's perspective, the artefacts are perceived as fully-designed technical facts, which require the persons operating them to engage in specific practices determined in advance. Constructivist approaches are helpful because they analyse technological development as an inter-subjective rather than an individual process, and make us aware of how a technology is developed through its use by many people. However, when it comes to studying how the technology is handled, on an everyday basis in institutional and professional settings, ethnographic studies of technology are also needed. These studies pay attention to ways in which the 'competent use of a system is embedded in conventional and routine ways of accomplishing particular activities, interactionally, within the organisational setting' (Heath and Luff 1996: 127). In the case of medical emergency centres, it is necessary to consider not only the specific practices in the centres, but that the centres are located and situated in institutions and among practitioners belonging to different professions. The examination of practice reveals a complexity that cannot be seen from a distance.

In the sections that follow; the technological mediation of the nursing-medical boundary in the Norwegian AMK centres is presented and discussed. The nurse-operated AMK centres represent a case where technological change leads to changes in professional boundaries. Svensson (1996) and Allen (1997) have discussed whether the boundary between nursing and medicine is a negotiated order. In the case of AMK centres it seems relevant to acknowledge the artefacts and technologies (communication tools and their operation) as actors, or 'actants' (Akrich and Latour 1992), taking part in this negotiation. Accepting the constructivist notion of non-human actors

(actants) makes us sensitive to how technology in the AMK centres takes part in an ongoing mediation or negotiation of the nursing-medical boundary.

Three 'boundary-spanning actions' made possible by communication technology in the AMK centres will be examined: first, how nurses are required to make decisions using doctors' tools (in the form of the Norwegian Medical Association's guidelines), second, how nurses perform a co-ordinating role which requires them to manage doctors 'on the road'; and third, how nurses answering telephone calls engage in activity that resembles medical 'diagnosis'. These boundary-spanning actions are not unique to nurses' work in the AMK centres, but they are more visible in the centres than in most hospital settings, because of the distance in time and space between doctors' and nurses' participation.

Method

During two years of empirical study, observations were conducted in six small AMKs (operated by a single nurse) and three large AMKs (operated by one or two nurses and an ambulance co-ordinator) in different parts of Norway (Tjora 1997b). Each observation period lasted between one and three full (8-hour) days and in some of the larger emergency centres two or three observation periods were completed. Activities were recorded using hand-written notes. Video recording was used during one three-day period in one of the larger emergency centres, but was problematic because it attracted too much attention from the workers in the centre. Semi-structured interviews were conducted with nurses, doctors and administrative personnel who were involved with the medical emergency centres or their development, but these interviews were considered secondary data. Emphasis was put on the way nurses and ambulance co-ordinators use technology in their practice, following an approach inspired by the 'ethnography of technological practice' (Suchman 1987, Hutchins 1988, 1990, 1995, Hutchins and Klausen 1996, Lave and Wenger 1991, Heath and Luff 1992, 1996, Smith and Whalen 1995, Orr 1996, Engeström and Middleton 1996). This involves studying people's use of technology as situated practice, emphasising the detailed utilisation of technology in relation to social (cognitive) practices. Within this approach detailed on-the-job observations and close analysis of texts, action and talk are performed to 'examine what people in modern jobs actually do' (Barley 1996: xiii).

Nurses' decisions with doctors' tools

The basic task of the nurses in the AMK centres is to screen patients to decide their level of urgency, based on an evaluation of the seriousness of the illness or injury. Underestimating the urgency of a case may have fatal

consequences. To help the nurses prioritise cases effectively, the Norwegian Medical Association has developed the *Norwegian Index for Medical Emergency Assistance*, hereafter called 'NI' (Norwegian Medical Association 1994). The NI provides a framework for evaluative/diagnostic work in the AMK centres. It is intended to regulate or standardise the quality of medical evaluations in the centres.

The NI is compiled as a book, but is also being developed as computer software that may be combined with standard medical software, and it is designed to help nurses perform 'evaluation' over the phone and liaise with doctors. In the Norwegian health service, the NI is unique in that it represents a national consensus in the area of diagnosis, developed by anaesthesiologists and general practitioners. It consists of a hierarchy of questions that can be followed so as progressively to narrow down options and arrive at a preliminary 'evaluation' from symptoms described by the caller. With NI, all nurses should be able to differentiate between patients who need the ambulance, or the doctor, and those who do not.

I conducted one of my observation periods just after there had been some local cases of meningitis, which had received considerable media coverage. The NI was used to differentiate between callers whose responses suggested that a meningitis diagnosis was a possibility and those that 'had just caught another cold'.

Can you bend your head down to your chest, or are you too stiff in the neck? – Well then, it's not meningitis, anyway.

It is stated in the directives for the AMK centres, that the use of NI is compulsory. Although the NI is now widely used in the AMK centres, it is, however, in practice not considered compulsory in all the centres. Many of the nurses do not want to use it as a standard method because they feel more comfortable with the use of their own medical knowledge and experience than 'reading from a book'. Nevertheless, many nurses use the book as a post-decision quality control, a knowledge bank and reference, to check their own medical decisions and to learn more about concrete cases after they have passed callers on to the doctor. It is also useful when the caller does not speak Norwegian, as there are English translations of questions and answer alternatives.

The fact that the Norwegian Medical Association has developed a guide so that nurses can perform diagnostic tasks is interesting in itself. Traditionally the doctor has had the role of the superior and has performed his role almost as a medical artist, capable of taming the mystery (Posner 1977) of medicine. By using the NI, however, nurses are introduced to some of the principles underlying doctors' diagnostic work. What makes the doctors willing to give some of their expertise in a systematic form to the nurses? How far then does the use of NI function to demystify medical knowledge and weaken professional authority?

One answer to the first of these questions may be found in the fact that the autonomous medical role, the 'medicracy', is already being dissolved (Berg 1991; Gabe *et al.* 1994). In the age of expert systems and artificial intelligence, it seems like a good strategy for a profession to keep control of its work domain by being the initiator of technological change, rather than the victim of it (MacDonald 1995: 172). Doctors may benefit from the development of NI, by delegating less interesting and routine activities to nurses at the AMK centres, but maintaining control of how the nurses perform the tasks.

We can better understand the way NI is designed by doctors for use by nurses by examining the analogy of the development of numerically controlled (NC) machine tools. There are two types of NC machine tools. The first type, the 'record-playback' system, involved the machinist making the first batch of components in a conventional way, using the machine manually. All the machinist's movements were recorded electronically so that the rest of the batch would run automatically. The other type of NC would read ready-made programmes via paper tape, which the operator simply loaded into the machine and unloaded – the rest was automatic. According to Noble (1979), it was only political and social considerations that made the second type the more frequently used, as it meant that control over the quantity and quality of production could be transferred from skilled machinists on the shop floor to programmers, who were assumed to be more responsive to managerial instructions (Wilkinson 1983: 88). There are similarities with Braverman's (1974) argument that directive documentation can be seen as an attempt to rationalise the work process, according to the scientific management tradition, so as to decrease dependence on skilled labour. In the same way as the programmed form of NC was chosen in America to maintain management control, one may look at the introduction of NI as a way for the doctors 'to programme' nurses' screening work. NI exemplifies an approach that seeks to pre-programme nursing work according to an idealised model of emergency medical decision-making, rather than an approach which tries to replicate good practice by examining how nurses actually make decisions in AMK centres.

As mentioned above, some nurses state that the use of NI is problematic because it binds them to rigid rules for categorising patients. In practice though, most nurses do not apply NI as a self-contained set of instructions of how to perform patient categorisation. Instead they usually try first to identify likely conditions without using NI. As pointed out by Hughes (1977), many of the evaluations made by nurses are based on everyday knowledge more than medical knowledge and draw on their previous experience of handling other people² with similar symptoms. A mechanistic application of NI would leave little scope for experiential knowledge. Moreover, the NI is not designed as a complete guide to the evaluation of callers. The present version of NI is not designed for untrained persons, but only for qualified nurses who are able to draw on expert knowledge in

addition to the NI. However, there is speculation within the NI development committee about the possibility of designing an NI suitable for use by a lay person. Studies in other areas show that guidelines that do not depend on the use of additional contextual knowledge are very difficult to write. According to Garfinkel (1967) it is impossible to write self-contained instructions³ and, as suggested by Orr (1996), in a study of photocopier technicians, the knowledge relevant to the job of faultfinding in Xerox machines cannot be precisely defined. Since diagnosis of human ailments is generally more difficult than diagnosis of faults in Xerox machines (it is at least harder to get advice from the designer), it seems reasonable to suggest that the same would be the case for nurses working in AMK centres.

Nurses' management of doctors

As noted by Allen in the UK context, it is not uncommon for nurses to organise doctors' work by saving up tasks, rather than bleeping the doctor for each problem as it occurred (1997: 510). Beyond this, doctors appear willing for nurses to perform certain tasks, like giving medication, that are officially within the medical domain, where this reduces pressure on over-worked doctors. Because doctors are not present in the AMK centres, because they are on the road, these settings provide good data on how the boundaries of medical work are constructed in nurses' practice.

Nurses' management of doctors' work becomes most visible when nurses are placed in managerial control positions in connection with processes such as utilisation review (Stearns 1991), or when experienced nurses interact with doctors with little local experience (Allen 1997; Hughes 1988). Nurses in the AMK centres are placed in a co-ordinating role for a doctor-on-call who is on the road, driving out to see patients at home, or at his or her office, having patients with minor ills to come to the doctor. In the larger Norwegian cities, the doctors-on-call tend to be on the road continuously for the whole duty. The nurses in the AMK centres are often dealing with inexperienced doctors, especially in rural areas of Norway, where there are problems with doctor coverage and many doctors rotate through short-term posts. Also, many hospital doctors work as doctors-on-call to get extra income. Because doctors are paid according to the number of consultations completed, AMK nurses must occasionally hold doctors back to stop them attending to trivial problems. As one GP put it:

It's more difficult to be on duty now because there are more requests than there used to be. Previously, people only rang the doctor when it was strictly necessary, but now it's a different matter. People used to be better brought up when it came to contacting the doctor, partly because of the stern local council doctors; for instance, parents of small children who scarcely dare do anything with their children. People aren't as accustomed

to judging for themselves what might perhaps be wrong with a child, for example. Ninety per cent of what takes place in casualty is quick things, perhaps too many quick things as the years go by. They easily use the clinic for trivial matters instead of waiting until the next day, and if a doctor is there just to earn as much money as possible, he'll say yes to everything. I've known nurses put their foot down when the doctor is too forthcoming, and they'll say 'No, for Christ's sake! You've got to tighten up now, otherwise it'll be chaos'. So they hold the lads in check (GP).

Although these interventions are rare, they illustrate how nurses in extreme cases are able to 'manage' the doctors.

Like nurses in British casualty departments (Hughes 1988), the nurses in the AMK centres collect information from patients to build up a picture of the presenting case, but do this via the telephone. Even though the physician on duty is formally responsible for clinical decisions, the AMK nurses constitute the first point of contact with the caller and make initial decisions out of sight of doctors. The nurses must decide whether or not to involve the doctor, based on a preliminary evaluation of the degree of urgency⁴. I will return to a discussion on this evaluation in the next section. In the case where a nurse directs a caller to the doctor, she will usually give the doctor a summary of the information collected, emphasising what she thinks is important but selectively omitting some details. By constructing descriptions of patients in particular terms, nurses can in a more or less explicit way communicate suggestions for action to the doctor. Nurses present to the doctor their notions of how serious cases are and in what sequence they should be handled by the doctor. At this stage the doctor has no direct contact with the patient and has to rely on the nurses' competence in assessing the information passed on.

However, there are many cases where callers to the AMK centre will not be connected by telephone to a doctor or referred for medical attention. Callers get advice from the nurses that is enough to solve their problems, at least temporarily. At face value nurses appear to be performing diagnostic tasks.

Nurses' diagnostics

Walby and Greenwell have observed that it is not uncommon for experienced nurses to advise newly qualified doctors about medication (1994: 22). Nurses in the AMK centres often give advice concerning medication directly to patients, for example, to advise elderly patients about permissible dosages:

At 11.15, a heart patient rings. The nurse learns that he has taken nitroglycerine without feeling better. She asks him to take another tablet while she is holding the line.

The AMK centre receives many calls of this kind and the callers usually get instant advice. Often the nurses will check on patients' progress, calling them back to ensure that their condition has not worsened. Other people also call to ask about medication use – what drugs can be used for particular conditions and the correct dosages. In this sense, the AMK centre works as a knowledge bank for medical questions, a *medical oracle* that is only a phone call away. Many AMK nurses are highly competent advisers because of their long experience of watching doctors communicate similar advice. When a doctor was not available at the time of the call, I have sometimes observed nurses' evaluations (or diagnostic interviews) lasting for up to 10 minutes. In the following example, there are two nurses at the AMK centre: Nurse1 and Nurse2.

A mother of a 13-year-old epileptic boy calls the AMK centre because the boy has come home from school with strange symptoms. Nurse2 answers the emergency phone. She establishes that it is a mother who is wondering what is wrong with her son, who suffers from epilepsy. Nurse 2 tries to get the mother to move through a series of tests to provide more information on what is wrong: 'If you take both his hands and he pinches hard with them both? See whether he's got just as much strength in both hands. Then you pinch the skin on both his arms. See whether he feels it equally'. She turns to Nurse1: 'Ann, I've got a mother on the phone here, who has a 13-year-old epileptic son and he's come home from school, dizzy, has a headache and feels numb on one side.' Ann joins Nurse2 to look at her notes, but just afterwards becomes engaged with another call. The mother is still on the line with Nurse2. 'So he's got a bit – has he the same strength in both hands? Get him to pinch hard with both hands – but what do you feel? – that he pinches equally hard? – You think so? – Is he pinching really hard? Does it hurt your hands when he pinches? You don't think there's any difference? – No, your hands. Do you think he's pinching you really hard? So he's got plenty of strength in his hands anyway? Both hands? Right, now you pinch him on the back of both hands and ask him whether he feels any difference between right and left. So it's not that he hasn't any feeling in the skin on one side? – Both eyes, or is there any particular side? – If he holds his hand over one eye, does he see clearly then? And then he changes to the other side. . . . His skin's not numb anywhere? Can he stand and walk? Can he move? If he gets up, can he move equally well on both sides? If he stands beside the bed, can he move his legs equally well? Get him to stand up beside the bed. – You know, it's important to get some information about this. Yes? And it went OK? Can he move forward a bit without any problem? Does he look any different when he walks? He doesn't walk in a funny way? . . . Is he pale? . . . No. What's his voice like? Is he in a cold sweat? And he has a headache.

An emergency call comes in on the 113 medical emergency number line, which Nurse2 has to take. She asks the mother to hold: 'Just hold the line,

don't hang up' and in a short time resumes the call: 'Now I'm back . . . Where does he ache in his head? Behind his eyes, yes. Can I have the date of birth of your son? And your telephone number. Hold the line and I'll be back, don't hang up, please.' Nurse2 turns to Nurse1:

Nurse 2: 'Ann, this boy here, what shall I do with him, he's got a headache, he feels dizzy, he feels funny on one side, he hasn't anything wrong that his mother can tell by pinching and. . . .'

Nurse1: 'pins and needles?'

Nurse2: 'No.'

Nurse1: 'No? . . . What sort of feeling?'

Nurse2: 'He feels that one side doesn't function as it should.'

Nurse1: 'Can he pinch?'

Nurse2: 'Yes, he can pinch. Purely objectively there's nothing wrong with him, but he feels himself that there's something wrong. He sees a bit oddly with one eye, not a cold sweat. He was seen by the health nurse and then he came home, and she's spoken with their own doctor and he said he would ring straight away.'

Nurse1: 'So their own doctor hasn't seen him?'

Nurse2: 'No.'

Nurse1: 'Where is he?'

Nurse2: 'Haven't asked, but they've got the phone number 12121212.'

Nurse1: 'That's up near where I live. What's his name?'

Nurse2: 'Ole Olsen'

Nurse1: 'Doctor Manson isn't available?'

Nurse2: 'No, he's not available.'

Nurse1: 'No, I'd almost – no, if he can't get to their own doctor, we really ought to have a doctor to see him.'

Nurse2: 'Yes, I really don't think we ought to wait.'

Nurse1: 'We can get him down here and tell "casualty" that they've got to take him in here then, they'll almost have to take him in when we don't have a doctor in town who can look at him. Yes, do that.'

Nurse2 puts the mother on again: 'I've been discussing it with a colleague here and we've agreed that it's best that you bring him here so that we can examine him properly. Can you do that? – I don't think you ought to wait so long, no . . . I'm sure everything will be OK, but since I can't see him, I think you ought to come here as quickly as possible so we can examine him here. No, but can't you take a taxi? – Yes, and I'll tell them you're coming into "casualty", in the emergency unit. I'll tell them you're coming. Okay? Bye.'

In this extended interaction, the nurse gets the mother to perform a succession of tests on her son, which are designed to provide grounds for a provisional diagnosis. But it is difficult for the nurse to get the mother to understand how to perform the specific tests, and the nurse has only the mother's responses to go on in making sense of what has been observed.

From what the mother says, the nurse cannot reach any firm decision about the boy's condition and she involves Nurse1 in reviewing the information that is available. They reach the conclusion that the mother should come with her son to the hospital. AMK-Nurse2 has by that stage spent about 10 minutes guiding the boy's mother to perform the various tests. In cases like these, when the doctor is not available, the nurses are conscientious in their attempts to solve the caller's problem, even if it takes some time.

The benefit of securing social and professional back-up from another nurse in the AMK centre is very important in the evaluation of ambiguous cases like the one referred to above. In my observations of the small one-nurse operated emergency centres I found that nurses rarely engaged in longer quasi-diagnostic interviews of the kind described earlier (Tjora 1997a). If the doctor is not available, they usually take a message to have the doctor call back, or if the case appears too urgent to wait they will connect the caller to one of the larger AMK centres. Hence, there is considerable variation in the nature of service provided by different centres, which has much to do with how competent the nurses feel and the size of their workloads. It should be noted that nurses in the smaller emergency centres usually have other obligations since the workload in the centre is so small.

Where doctors were not available, nurses in larger centres would regularly draw on professional experience and the pooled knowledge of colleagues to try to diagnose patients' conditions over the phone:

A mother rings the AMK centre because her infant son has complained of a bad taste in his mouth. She explains that she found him licking a bottle that had contained windscreen washer liquid. It was probably empty, but the mother doesn't know whether the boy has swallowed any liquid and is worried. The nurse consults the poison index, rings others who should know and discusses the matter with colleagues in the AMK centre before finally giving the mother, who is holding the line, an answer that satisfies her.

Parents often call the AMK centre because they are worrying about their children having ingested poisonous substances, being seriously ill, or having hurt themselves badly enough to require medical attention. The nurses handle many of these calls without having to involve the doctor, by using written sources of information, discussing the matter with other nurses in the AMK centre and using their own judgement. The two nurses pool their knowledge, to use 'joint-competence' as a basis for action. Joint-competence feels safer than one's own competence, even when all team members possess similar expertise.

It seems obvious for the nurses that many calls concern mere trifles, but they are responded to with seriousness. By using their experience and the support of colleagues and printed reference materials, the nurses are capable of offering advice over the phone so that many unnecessary doctor consultations are avoided.

Discussion

The nurses who staff AMK centres may appear to perform rather autonomously, since they give advice to patients that is not dissimilar to the advice a doctor might offer. But is it the advanced technology of the centres that creates this opportunity for autonomous work, or is this autonomy a feature of all health settings which involve the initial screening of presenting patients? As we have seen, especially from the studies by Hughes (1977, 1980, 1988), nurses perform screening tasks that are used as information by doctors in their diagnosis of patients. Often these tasks are handled by the nurses in such a way that the traditional division of labour between doctor and nurse is maintained (Stein 1967, Wheeless *et al.* 1989). In the AMK centres, on the other hand, the extent of nurses' autonomy becomes more visible, since doctors are not usually physically present to oversee activities. As presented by Gamarnikow, the nurse's role cannot be rigidly separated from diagnosis and prescription, as the role includes sifting 'through a large number of observations', picking out the ones that are medically relevant, which means 'operating the medical diagnostic framework, linking it to her own medical experience of similar cases and creating a construct – the reporting of symptoms – of medically relevant information' (1991: 119). These decisions are made more explicit in the AMK centre than in other departments where the nurses' work may be more closely in continuous co-ordination with, or supervised by, physicians. Moreover, the nurses' 'management' of the doctor on the road is more visible than the nurses' management in a ward because only the nurses in the centre have a general view of the resource situation at any time. Especially in emergency situations, the AMK centre is the central node in the information network and everyone else has to rely on the supply of information from the nurse.

One of the main advantages of the larger AMK centres is that they give nurses an opportunity to develop their knowledge and experience through social interaction with colleagues in the centre. In these professional exchanges, specific medical cases are discussed and new knowledge is socially developed through this discussion and evaluation of one's own and others' practice. Medical reference books, like NI and the Norwegian Pharmacopoeia⁵ are used to check their judgements. Also during telephone conversations, the nurses are able to discuss the case at hand. Even if a caller is referred to a doctor, nurses often discuss an 'interesting' case afterwards. Sometimes they will consult the NI and other medical texts to check whether what they did was right and see whether things had been missed.

One nurse is not super-ordinate to the other and there is no reason for one nurse to believe that the other would have more diagnostic expertise. However, collegial interactions of this kind were seen as a way of moving towards organisationally acceptable decisions, through joint-competence.

Approval from colleagues helps to reinforce a sense of personal competence, and also provides the reassurance of shared ownership of decisions.

Through the introduction of the *Norwegian Index for Medical Emergency Assistance* the doctors (*i.e.* the Norwegian Medical Association) have tried to standardise the work of the nurses in the AMK centres. However, the index was created on the assumption that the nurses follow specific rules and only those rules, when evaluating callers and their medical problems. Therefore, use of the index is problematical, since it takes no account of the nature of real-world decision-making, which is based on a mix of professional and personal knowledge, experience and common sense. To follow the NI rigorously does not feel right for the nurses and, in their view, does not guarantee that correct decisions will be made. Decision-making is not a purely technical matter, reducible to pre-determined rules, because the working procedures are embedded in existing organisational practices and networks of actors (Granovetter 1985). The NI is a protocol in Berg's terms, comprising 'written instructions' that guide 'medical personnel through a sequence of steps' (1997: 1081). As pointed out by Berg, the abundant attention to a protocol 'reinforces the tendency to perceive and describe the management of patients' trajectories as constituted by a sequence of individual, formally rational decisions' (1997: 1082). Furthermore, 'the protocol also contributes to the widespread illusion of the single answer' (1997: 1083). The hierarchical structure of NI is more of a constraint than an aid to effective decision-making, because it squeezes the nurse-patient dialogue into a rigid procedural framework. The decision-making process of the nurses is in many cases socially accomplished, in collaboration between two or more nurses. Consequently, the NI does not support the practice of decision-making that the nurses actually apply in the AMK centres. Rather it supports a formal model of individual decision-making.

An important part of practice in hospital wards is the doctor-nurse interaction as described by Hughes (1988) and Allen (1997), where nurses are participants in a joint decision-making process with doctors, in medical as well as in administrative matters. However, the doctors behind the design of NI have paid insufficient attention to nurse competence and practice, and have not fully taken into account nurses' ability and need to be a part of the decision-making process. NI is designed as a rule-based decision tool and cuts across established ways of working. Some of the most experienced nurses resist its routine use because they prefer to make decisions on the basis of their own knowledge and experience. Many nurses employ NI only as a backup system for use with difficult cases. Moves now occurring in some AMK centres to make the use of NI compulsory in actual practice are therefore deeply problematical, because they rely on an idealised concept of nursing work, which bears little relation to actual practice.

Applying terminology from science and technology studies (*e.g.* Bijker *et al.* 1987), one may say that technology and practice in the emergency centres are 'interpretatively flexible' (Pinch and Bijker 1987: 40). This means

that the various relevant interest groups interpret the AMK centres, and what their mission is, differently. Nurses perceive the centres as autonomous medical care centres, whereas doctors see them primarily as a mechanism for channelling patients towards services located elsewhere. The design of the Norwegian Index, as a fixed way of specifying preliminary diagnosis, or at least urgency degrees, from callers' descriptions, is based on the doctors' interpretation of the emergency centres. However, AMK nurses interpret their work as a form of nursing practice, meaning that it is 'strongly experience based and in parts intuitive and immediate' (Wagner 1994: 61). As pointed out by Suchman (1987) plans (such as the NI) cannot totally prescribe actions because actions are situated in time and place. If we accept both the constructivist notion of how the workability of the technology is a practical accomplishment of the users, and the lesson from ethnographic studies that use of a system is embedded in conventional and routine ways of accomplishing particular activities, it is easier to see the potential of the use of NI as fulfilled by the way it is used for categorising already made decisions for documentation.

In interviews with nurses, Hughes (1988) found that they did not count themselves as taking part in diagnosis because they did not inform the patient of his or her condition or make any firm pronouncements about it. In the same way, a nurse in one of the AMK centres told me that the use of 'Norsk Indeks',

is not to give a diagnosis, but only to give a response to the bodily signs as described by the patient or the caller (AMK nurse).

However, my observations have shown that nurses in the AMK centres perform many tasks without doctors' involvement to solve people's medical problems. That they do not define these tasks as 'diagnosis' may reflect a political need to keep a low profile, but underestimates the complexity of the judgements they make. As Allen (1997) remarks, there are often discrepancies between nurses' accounts of their work and what they actually do, so that observations are necessary as primary data.

The experience of Norwegian AMK centres is relevant to the development of nurse-led telephone services in other countries, like, for instance, 'NHS Direct' in the UK. Typically, medical information centres are staffed by nurses and aim at reducing demands on other health services. These information services intend to refer some cases to doctors and provide appropriate responses to patients who do not need an immediate medical consultation. But whereas in the AMK centres the protocol 'Norwegian Index' is in practice being applied as an after-the-call categorisation tool, other information services, like NHS Direct, purport to rely (heavily) on decision-support software designed to help nurses screen telephone callers seeking treatment or advice. The study of the AMK centres has showed that it is primarily nurses' opportunity to apply both their individual competence

and experience and a joint-competence that make them succeed in handling phone calls. There is reason to believe that further development of medical information services will need to address questions about the development of nursing competence and collegiality as opposed to and, in addition to, use of 'software-driven' decision-support systems.

Conclusion

In this paper I have examined social settings in which inter-professional relationships between doctors and nurses are mediated by technologies which enable the two groups to communicate at a distance, namely the Norwegian AMK centres. Observation of nurses' practice in the AMK centres shows that they are able to perform tasks of screening, evaluating or diagnosing via the phone rather autonomously. Moreover, this supports many of the findings of earlier studies of the doctor-nurse relationship (Hughes 1988, Allen 1997). Because of their co-ordinating role in the centres there are times when nurses 'manage' doctors, in the sense of controlling their involvement with particular patients and filtering the information they receive. This is not a new phenomenon, but it is made more explicit in the AMK centres because most communication between nurses and doctors occurs via the phone, and cannot depend on the subtle cues that can be used in face-to-face interaction.

The Norwegian Medical Association has developed NI, the *Norwegian Index for Medical Emergency Assistance*, as a protocol to help nurses perform the screening or evaluation tasks of the AMK centre. There are moves to implement a compulsory use of NI by AMK nurses, which may represent an attempt by doctors to increase their control of the division of labour by programming nurses' work. This programming of nursing work is based on the use of a formal, rule-based decision tool rather than experience based practice. It takes little account of nurses' preference for flexible decision-making. However, use of a decision support tool designed by doctors has important implications in establishing the medical profession's jurisdiction over this domain of work. By keeping NI within the realm of medical-rational decision-making, the doctors allow nurses to engage in 'evaluation' of patients without risking an assimilation of their legal and public jurisdiction (cf. Abbott 1988: 68); 'evaluation' (and diagnosis) remain under medical control.

The findings of the research on the use of communication technology in medical emergency centres show that the use of technology may serve as one form of professional mediation in the health services. Various professions apply different strategies to cope with new technical solutions in the health institutions, to gain autonomy rather than lose control over the use of their competence. As more information systems are implemented in the health services (for example, electronic patient journals, administrative systems,

regional and national health networks and internet services), different potentialities (Feenberg 1999) of the technologies may appear because of inter-professional negotiations, among others. This paper has emphasised how such (more or less explicit) negotiations are forming various meanings of a specific technical artefact, hence forming the use of the technology in its context. Studies of health technologies need to address this emergent nature of technology-in-use and the relevance of professional and other factors in technology implementation.

Address for correspondence: Aksel Hn Tjora, Department of Sociology and Political Science, Norwegian University of Science and Technology, N-7491 Trondheim, Norway
Email: akselht@svt.ntnu.no

Acknowledgements

The research on which this paper is based was funded by Telenor Research. I am grateful to Simon Thompson for linguistic advice and the anonymous referees and the editors of SHI for constructive comments on earlier versions of this paper.

Notes

1. In a GPS (global position system), satellites are used for very accurate positioning and marking of emergency callers and ambulances.
2. Nurses and other staff in the casualty departments and hospital wards have to apply their non-medical knowledge as the first screening criteria to identify 'deviant patients' (Jeffrey 1979), 'problem patients' (Mannon 1976) or 'malingerers, hypochondriacs and troublemakers' (Hughes 1977).
3. Instructions rely upon an implicit *et cetera* clause in order to be called complete. 'Ad hocing' is required to grasp the relevance of instructions. 'To treat instructions as though *ad hoc* features in their use were a nuisance, or to treat their presence as grounds for complaint about the incompleteness of instructions, is very much like complaining that if the walls of a building were only got out of the way one could see better what was keeping the roof up' (Garfinkel 1967: 22, original italics).
4. The urgency degree determines such things as whether an ambulance should be requested and be put on a schedule (regular – green), requested at once (urgent – yellow), or requested immediately and with the flashing beacon (acute emergency – red).
5. 'Felleskatalogen'.

References

Abbott, A. (1988) *The Systems of Professions: an Essay on the Division of Expert Labour*. Chicago, University of Chicago Press.

- Akrich, M. and Latour, B. (1992) A summary of a convenient vocabulary for the semiotics of human and nonhuman assemblies. In Bijker, W.E. and Law, J. (eds) *Shaping Technology/Building Society*. Cambridge Ma: MIT Press.
- Alban, A. and Christiansen, T. (eds) (1995) *The Nordic Lights. New Initiatives in Health Care Systems*. Odense: Odense University Press.
- Allen, D. (1997) The nursing-medical boundary: a negotiated order? *Sociology of Health and Illness*, 19, 498–520.
- Argyris, C. and Schön, D.A. (1978) *Organizational Learning: a Theory of Action Perspective*. Reading Ma: Addison-Wesley.
- Barley, S.J. (1996) Foreword, In Orr, J.E. *Talking About Machines. An Ethnography of a Modern Job*. Ithaca: ILR Press/Cornell University Press.
- Berg, M. (1997) Problems and promises of the protocol, *Social Science and Medicine*, 44, 1081–88.
- Berg, O. (1991) Medikrati, hierarki og marked. In Album, D. and Midré, G. (eds) *Mellom Idealer og Realiteter. Studier i Medisinsk Sosiologi*. Oslo: Ad Notam.
- Bijker, W.E., Hughes, T.P. and Pinch, T. (eds) (1987) *The Social Construction of Technological Systems*. Cambridge Ma: MIT Press.
- Bijker, W.E. and Law, J. (eds) (1992) *Shaping Technology/Building Society*. Cambridge Ma: MIT Press.
- Braverman, H. (1974) *Labor and Monopoly Capital: the Degradation of Work in the Twentieth Century*. New York: Monthly Review Press.
- Bruce, A. and Jonsson, E. (1996) *Competition in the Provision of Health Care. The Experience of the US, Sweden and Britain*. Aldershot: Arena.
- Button, G. (1993) The curious case of the vanishing technology. In Button, G. (ed) *Technology in Working Order*. London: Routledge.
- Coddington, D.C. and Moore, K.D. (1987) *Market-Driven Strategies in Health Care*. San Francisco: Jossey-Bass.
- Ellefsen, B. (1995) *Når Organisasjon og Yrke Møtes*. Oslo: Department of Sociology, University of Oslo.
- Elston, M.A. (1997) Introduction: the sociology of medical science and technology. In Elston, M.A. (ed) *The Sociology of Medical Science & Technology*. Oxford: Blackwell.
- Engeström, Y. and Middleton, D. (eds) (1996) *Cognition and Communication at Work*. Cambridge: Cambridge University Press.
- Exworthy, M. and Halford, S. (eds) (1998) *Professionals and the New Managerialism in the Public Sector*. Buckingham: Open University Press.
- Feenberg, A. (1999) *Questioning Technology*. London: Routledge.
- Flynn, R. and Williams, G. (eds) (1997) *Contracting for Health*. Oxford: Oxford University Press.
- Freidson, E. (1994) *Professionalism Reborn. Theory, Prophecy, and Policy*. Chicago: The University of Chicago Press.
- Gabe, J., Kelleher, D. and Williams, G. (eds) (1994) *Challenging Medicine*. London: Routledge.
- Garmarnikow, E. (1991) Nurse or woman: gender and professionalism in reformed nursing 1860–1923. In Holden and Littlewood (eds), *Anthropology and Nursing*. London: Routledge.
- Garfinkel, H. (1967) *Studies in Ethnomethodology*. Cambridge: Polity Press.
- Granovetter, M.S. (1985) Economic action and social structure: the problem of embeddedness, *American Journal of Sociology*, 91, 481–510.

- Heath, C. and Luff, P. (1992) Collaboration and control. Crisis management and multimedia technology in London Underground Line Control Rooms, *Computer Supported Cooperative Work*, 1, 69–94.
- Heath, C. and Luff, P. (1996) Convergent activities: line control and passenger information on the London underground. In Engeström, Y. and Middleton, D. (eds) *Cognition and Communication at Work*. Cambridge: Cambridge University Press.
- Hughes, D. (1977) Everyday and medical knowledge in categorising patients. In Dingwall, R., Heath, C., Reid, M. and Stacey, M. (eds) *Health Care and Health Knowledge*. London: Croom Helm.
- Hughes, D. (1980) The ambulance journey as an information generating process, *Sociology of Health and Illness*, 2, 115–32.
- Hughes, D. (1988) When nurse knows best: some aspects of nurse/doctor interaction in a casualty department, *Sociology of Health and Illness*, 10, 1–22.
- Hughes, E.C. (1958) *Men and their Work*. New York: Free Press.
- Hutchins, E. (1988) Organizing work by evolution and by design, *Conference on Work and Communication*, University of California, San Diego, July.
- Hutchins, E. (1990) The technology of team navigation. In Galegher, J., Kraut, R. and Egido, C. (eds) *Intellectual Teamwork: Social and Technological Foundations of Cooperative Work*. Hillsdale NJ: Lawrence Erlbaum Associates.
- Hutchins, E. (1995) *Cognition in the Wild*. Cambridge Ma: MIT Press.
- Hutchins, E. and Klausen, T. (1996) Distributed cognition in an airline cockpit. In Engeström, Y. and Middleton, D. (eds) *Cognition and Communication at Work*. Cambridge: Cambridge University Press.
- Jeffrey, R. (1979) Normal rubbish: deviant patients in casualty departments, *Sociology of Health and Illness*, 1, 90–107.
- Latour, B. (1987) *Science in Action*. Cambridge, Ma: Harvard University Press.
- Lave, J. and Wenger, E. (1991) *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.
- Law, J. (ed) (1991) *A Sociology of Monsters: Essays on Power, Technology and Domination*. London: Routledge.
- MacDonald, K.M. (1995) *The Sociology of Professions*. London: Sage Publications.
- MacKenzie, D. and Wajcman, J. (eds) (1985) *The Social Shaping of Technology*. Milton Keynes: Open University Press.
- Nelsen, B.J. (1997) Work as a moral act: how emergency medical technicians understand their work. In Barley, S.R. and Orr, J.E. (eds) *Between Craft and Science: Technical Work in U.S. Settings*. Ithaca: ILR Press/Cornell University Press.
- Noble, D.F. (1979) Social choice in machine design: the case of automatically controlled machine tools. In Zimbalist, A. (ed) *Case Studies in the Labour Processes*. New York: Monthly Review Press.
- Norwegian Medical Association (Den norske lægeforening) (1994) *Norsk Indeks for Medisinsk Nødhjelp*. Stavanger: Åsmund S. Lærdal A/S.
- Orr, J.E. (1996) *Talking about Machines. An Ethnography of a Modern Job*. Ithaca: ILR Press/Cornell University Press.
- Pinch, T.J. and Bijker, W.E. (1987) The social construction of facts and artifacts: or how the sociology of science and the sociology of technology might benefit each other. In Bijker, W.E., Hughes, T.P. and Pinch, T. (eds) *The Social Construction of Technological Systems*. Cambridge Ma: MIT Press.

- Posner, T. (1977) Magical elements in orthodox medicine. In Dingwall, R., Heath, C., Reid, M. and Stacey, M. (eds) *Health Care and Health Knowledge*. London: Croom Helm.
- Rushing, W.A. (1962) Social influence and the social-psychological function of deference: a study of psychiatric nursing, *Social Forces*, 41, 142–8.
- SHD (The Norwegian Ministry of Health and Social Affairs) (1988) *Ot.prp. nr. 26 1988–1989*. On telecommunication in the health services, including medical emergency service. Oslo: SHD.
- SHD (The Norwegian Ministry of Health and Social Affairs) (1990) *Regulations on Medical Emergency Service*, 20 August. Oslo: SHD.
- Singleton, E.K. and Nail, F.C. (1984) Autonomy in nursing, *Nursing Forum*, 21, 123–30.
- Smith, D.E. and Whalen, J. (1995) *Texts in Action*, unpublished paper, University of Toronto and University of Oregon.
- Stearns, C.A. (1991) Physicians in restraints: HMO Gatekeepers and their perceptions of demanding patients, *Qualitative Health Research*, 1, 326–48.
- Stein, L.I. (1967) The doctor-nurse game, *Archives of General Psychiatry*, 16, 699–703.
- Suchman, L.A. (1987) *Plans and Situated Actions: the Problem of Human-Machine Communication*. Cambridge: Cambridge University Press.
- Svensson, R. (1996) The interplay between doctors and nurses – a negotiated order perspective, *Sociology of Health and Illness*, 18, 379–98.
- Tjora, A.H. (1997a) Wireless not Careless, *The International Human Science Research Conference*, Trondheim, August 16–20.
- Tjora, A.H. (1997b) *Caring Machines: Emerging Practices of Work and Coordination in the Use of Medical Communication Technology*. Doctoral thesis, Faculty of Social Sciences and Technology Management, Trondheim: Norwegian University of Science and Technology.
- Wagner, I. (1994) Hard times. The politics of women's work in computerised environments, *5th International Conference on Women, Work and Computerization*, 61–72.
- Walby, S. and Greenwell, J. (1994) *Medicine and Nursing. Professions in a Changing Health Service*. London: Sage.
- Wheless, V.E., Wheless, L.R. and Riffle, S. (1989) The role of situation, physician communicator style, and hospital rules climate on nurses' decision styles and communication satisfaction, *Health Communication*, 1, 189–205.
- Wilkinson, B. (1983) *The Shopfloor Politics of New Technology*. London: Heinemann Educational Books.