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REVIEW ARTICLE

The effects of PACS on radiographer's work practice

W. Larsson [a,*], P. Aspelin [a], M. Bergquist [b], K. Hillergård [a], B. Jacobsson [c], L. Lindsköld [a], J. Wallberg [a], N. Lundberg [a]

[a] *CLINTEC, Karolinska Institutet, Stockholm, Sweden*
[b] *Department of Informatics, University of Gothenburg, Sweden*
[c] *Department of Paediatric Radiology, Mölndals Hospital, Gothenburg, Sweden*

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Abstract This paper identifies and analyses the effects of picture archiving and communication systems (PACS) on radiographers' work practice. It shows that the introduction of PACS did not simply entail the transfer of data and information from the analogue world to the digital world, but it also led to the introduction of new ways of communicating, and new activities and responsibilities on the part of radiography staff. Radiographers are called upon to work increasingly independently, and individual practitioners require higher levels of professional expertise. In all, this paper demonstrates that new technical solutions sometimes lead to substantial changes in responsibilities in work. In this example, the radiographers' work practice has become more highly scientific and they are enjoying a higher level of prestige.

Introduction

Radiographic work is a highly structured, production-oriented, complex, distributed, technical, and image-centred activity. The digitalisation of radiography has expanded very rapidly during the past decade. Many different health professionals undertake X-ray examinations, including radiologists, radiographers, and dentists. In this study we are focusing on the work of radiographers, including radiology nurses and radiological technicians. Most Swedish radiology departments use radiological information systems (RIS) which have been in use for more than 15 years. An RIS is used for administrative purposes, and includes functions for communicating and managing patient data, patient registration, scheduling radiological examinations, and for creating reports used for accounting. It also generates radiological reports. They also use PACS, which is an internationally used system for electronic storage, retrieval, distribution, communication, display, and processing of medical imaging data.[1] PACS replaced the use of X-ray film and much of the equipment associated with this technology, such as light boards, cassettes, film production machines, shelves, tables, printers, and archive

* Corresponding author. Karolinska University Hospital Huddinge (C1-40), SE-141 83 Stockholm, Sweden.
E-mail address: wiveca.larsson@ki.se (W. Larsson).

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storage, which explain the analogue environment. For many decades, these items have shaped radiographers' working practices and their working environments. This paper describes and analyses how radiographers' working practice changes in the transition from analogue to digital environment using PACS. It focuses on the changes in activity and changes in the professional role. Compared to conventional X-ray film, digital PACS images have properties that both create new demands and have various effects on work activities, professional roles and communication in work.

In this process, ''The tools used are not isolated artefacts but social and material parts of medical work.''[1(pp. 1)] Therefore, the tools are addressed in this study as ''tools in use''.[2(pp. 117)] The diagnostic work progresses from one activity to another, just as responsibility for the patient moves from administrative staff to radiographers to radiologists, etc. This means that the work done by one actor is of great interest to a series of actors. The process is documented both in the RIS and the PACS. For instance, the radiographer receives the information from the RIS. Apart from RIS, communication in the digitised department takes place by means of telephone calls and documents as well as face-to-face. Bardram describes that the information process is an act of communication, in which people use objects linked to many other objects to communicate with other people.[3]

The introduction of filmless radiology through the use of PACS leads to dramatic changes in radiographic work. A study by Pilling describes that the change in the use of technology is in the implementation of PACS, which entails the transition from hard-copy films to digital images. PACS provides for easier, more cost-effective storage and distribution. PACS enables simultaneous access by multiple users, fast access in trauma settings and comprehensive access to the records of previous investigations.[4] Yet it would appear that this is not a well-researched topic, as we have been unable to identify any previous research into the consequences of the introduction of PACS on radiographers' working practice.

Research design

Ethnography

The method used in this study is ethnography. Ethnography is a highly qualitative and open-ended research method developed by disciplines such as anthropology and sociology for understanding the relationships between practices, value systems and the organisational (and even societal) context.[5,6] This is done through comprehensive studies of, for instance, individuals' work practices. The main methods used are observation and in-depth interviews. The ethnographic study approach is used to produce detailed descriptions of activities within various work settings. Ethnography may be used to describe a particular work domain during a recurring but delimited time, such as a working day. In ethnographic studies, the researcher tries to describe and understand activities as the people involved understand them.[7] Over the last decade, ethnographic research methods have become recognised as useful within the field of information systems (IS) research and practice.[1,2,8–11] Ethnographic observation is a technique used to describe and document practices and interaction among organisational actors. Observations are documented using field notes. The researcher observes and documents a wide variety of situations; in this case situations where the actual work practices become visible. However, in ethnographic studies it is recommended that observation be combined with interviews in order to develop an understanding of the values and norms that might be ''hidden'' behind an actual practice. The explanations may provide the researcher with a deeper understanding of the relationship between practice and context. However, it has been noticed that interviews can be biased, in the sense that people make statements regarding their activities that are actually not supported by their work practice. It has therefore been suggested that the researcher should try to combine observations and interviews, and in the analytical phase triangulate the results from the different methods used.

It was seen as important to include ethnographic techniques in the methodology for this study of radiology as a workplace and of radiography as a work activity. We wanted to capture an understanding of naturally occurring work activities in real-world settings. Ethnography gave us a tool with which we were able to see what the work looks like from the workers' point of view. Combining observations and in-depth interviews made it possible to recognise the distinction between what people say they do and what they actually do, which is crucial for any consideration of effective and beneficial workplace redesign.[12] Since we aimed to present a picture of radiographers work as seen and understood by the radiographer before and after the introduction of PACS, ethnography has provided a fruitful point of departure. Ethnography supports the in-depth, real-life study of the processes taking place. Many researchers emphasise the understanding and representation of the real work practice, noting that the way those people work is not always clearly apparent.[7,12] By outside researcher, we can easily fall into the trap of allowing our view of radiographic work to become simplified and stereotyped because we are in practice quite distant from it.

Empirical fieldwork – interviews

Empirical fieldwork began in October 2003 and finished in 2005. Altogether, 15 radiographers were interviewed at

Table 1 Number of interviews and observations at hospitals

Hospitals	Radiographers interviewed & observed
Karolinska University Hospital Solna	2
Karolinska University Hospital Huddinge	4
Danderyd Hospital	3
Södertälje Hospital	3
Ryhov Hospital Jönköping	3