Electronic Health Records in Sweden –
From Administrative Management to
Clinical Decision Support

History of Nordic Computing 3, IFIP
Stockholm 2010-10-18

Karin Kajbjer, Ragnar Nordberg,
Gunnar O Klein

Linköping University
JMPRD

KI
Origin of automatic decision support in Medicine

- Ramon Llul 3th century scholar i Mallorca
- Three paper discs combining
  - Symptoms
  - Diagnosis
  - Treatment
First Swedish experiences

• Computer support for health care started in Sweden in the mid 1960ies with a series of pilot tests with clinical records at the Karolinska Hospital.
• Batch processing on an IBM mainframe based on punched cards.
Laboratory Automation 1970-

• Automated analysis instruments like the Swedish produced AutoChemist, the English Vickers and the Swiss Greiner analyzers all had interfaces which made them compatible with most computers.

• Increased productivity

• This also made it possible to send out the laboratory results to the wards and primary care units electronically

• Cumulative lists of results and Quality management
Patient Administrative System - PAS

• The 1970ies and first part of 1980ies also saw several independent developments of patient administration systems based on central mainframes in the counties and a large number of dumb terminals in the hospitals and later also in the outpatient clinics.

• These managed invoicing and allocation of hospital beds and certain related tasks.
PAX

• One of the administrative systems developed was PAX in Gothenburg. This was created after a number of other incompatible systems had been installed, tested and disqualified.

• There was a big fight about which system was the best and should be used before the decision was taken to develop a total new system. This created peace – pax.
Primary care Electronic Health Record Systems in Sweden
Swedestar

- Introduced in Lerum [2] and Sundbyberg in 1984 and is still with minor modifications in use in several places. This was a modification of the Costar developed in Boston closely associated with the MUMPS operating system with integrated database function.
- A similar development in Finland was the Finnstar system.
- An important and novel idea at the time was to record all clinical information associated with certain keywords from a defined local terminology.
Proliferation of PC based systems 1990ies

• A next step was a proliferation of a large number of PC based small systems that in many cases could be seen more like word processing systems than advanced management of structured data.

• These were often developed by a physician in co-operation with one or a few more or less self-made software engineers.
The products 1994

<table>
<thead>
<tr>
<th>System name</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMA</td>
<td>Mediflex Data AB</td>
</tr>
<tr>
<td>APEX</td>
<td>DDE Sverige AB</td>
</tr>
<tr>
<td>Axep</td>
<td>INEQ AB</td>
</tr>
<tr>
<td>Bedside</td>
<td>Celsius Information System</td>
</tr>
<tr>
<td>BIOSIS</td>
<td>Health Allocation System AB</td>
</tr>
<tr>
<td>BMS journal</td>
<td>Bonjour Medical System AB</td>
</tr>
<tr>
<td>Dialog Journal</td>
<td>Celsius Information System</td>
</tr>
<tr>
<td>Dr Grans Datorsystem</td>
<td>Gran Data AB</td>
</tr>
<tr>
<td>Infodoc</td>
<td>Sysdeco Profdoc AB</td>
</tr>
<tr>
<td>Journal II and Journal III</td>
<td>Sysdeco Profdoc AB</td>
</tr>
<tr>
<td>Journalia</td>
<td>Journalia AB</td>
</tr>
<tr>
<td>Mac Adapt</td>
<td>Frontec Care System AB</td>
</tr>
<tr>
<td>MacDoc II</td>
<td>Esmeralda AB</td>
</tr>
<tr>
<td>Medex</td>
<td>Medex Sverige AB</td>
</tr>
<tr>
<td>Medicus</td>
<td>Data 16 AB</td>
</tr>
<tr>
<td>Medidoc</td>
<td>Medidoc AB</td>
</tr>
<tr>
<td>Medilite</td>
<td>PCD Applitron AB</td>
</tr>
<tr>
<td>Melior</td>
<td>Siemens AB</td>
</tr>
<tr>
<td>MIA vård</td>
<td>Infoservice Sweden AB</td>
</tr>
<tr>
<td>Patientjournalen</td>
<td>Patientjournalen AB</td>
</tr>
<tr>
<td>PC-Praxis</td>
<td>Lap Power</td>
</tr>
<tr>
<td>PMS</td>
<td>Bergsjö Data AB</td>
</tr>
<tr>
<td>Promed</td>
<td>PRO International AB</td>
</tr>
<tr>
<td>Swede Star 2.0</td>
<td>Celsius Information System</td>
</tr>
<tr>
<td>VANIA</td>
<td>CAP Programator</td>
</tr>
<tr>
<td>VAS</td>
<td>CAP Programator Stockholm AB</td>
</tr>
<tr>
<td>WordPics</td>
<td>DAFA Syd AB</td>
</tr>
</tbody>
</table>
Why so many systems?

• We believe that an important reason for the popularity of these small scale developments was the feeling of participation from the clinical staff that were allowed to influence many details of the systems.

• This was in contrast to the introduction later of in some ways more advanced systems that were introduced through the central IT management.
Lesson forgotten

• The importance of defined terminologies to allow co-operation and scientific analysis
• This was well understood 50 years ago but during the 1990ies explosion forgotten
• More recently both Denmark and Sweden have made major efforts to translate the ontology based Systematized Nomenclature of Medicine, SNOMED
• >300 000 terms > 1,5 million relations
Hospital systems

• The **Ystad** case

• The first Swedish hospital to really comprehensively use an electronic health record system was Ystad, a small hospital with 190 beds in southern Sweden in what is now the region of Skåne. This installation used the Swedestarr system described above.

• The project [3] was initiated in 1989.
Short term goals

• Less manual work for notes, referrals, labresults etc
• More efficient care through better access to information
• Support to the nurses and evaluation of the nursing care
• Possibilities for change and trials of new processes in outpatient clinics and clinical wards
• Improved privacy protection
• Improved work situation for the assistant nurses with less time for paper work and more for direct patient care.
Long term goals

• Improved assessment of the production and costs
• Improved quality management
• Improved competence of the staff

In the overall assessment 1994 the goals were at least partially met in all aspects but 25 % of the staff felt that the computer record worked worse or much worse than anticipated.
Melior – The Sahlgrenska development

• The Sahlgrenska University hospital is a large teaching hospital in Gothenburg. They started to develop their own EHR system in 1988 using a then rather modern Microsoft technology
• The new version was installed in 1994
• Still used there and in a large number of other hospitals
• Now developed and supported by Siemens
Attempts to standardize systems for interoperability

• Various national activities, in Sweden mainly through SPRI
• European standardization in CEN/TC 251 Health informatics resulted in important foundation principles but no interoperability in the 1990ies
• Became the basis of ISO EN 13606: Electronic Health Record Communication
Conclusions

• A complicated business sector
• Sweden and the Nordic countries were pioneers with large scale activities
• Many of the small commercial products quickly went out of business but are still used
• Life time 15-20 years