Renal Telemedicine & Telehealth
Where Do We Stand?

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MEDICON 2010, Chalkidiki, Greece, May 27-30, 2010
renal disease

early diagnosis, efficient & agile management and prognosis are imperative, as kidney chronic disease may lead to

- several and severe health complications
  (hypertension, nephrogenic anemia, peripheral neuropathy, cardiovascular disease, ...)

- kidney failure

- considerably reduced quality of life

- (eventually) death
renal failure incidence in 2006

USA > 350/M

Japan ~ 300/M

several EU countries ~ 180/M

Bars: Rate per million population (USRDS 2008)
renal failure projection

patients with renal failure increase, mainly due to increased incidents of diabetes and hypertension
treatment for kidney failure

- renal transplantation

- dialysis: removal of water and body wastes that build up in failing kidneys
  - hemodialysis at the hospital (artificial kidney)
  - home hemodialysis
  - peritoneal dialysis (at home)
monitoring renal disease

a good measure for early diagnosis, treatment adjustment and rehabilitation

- chronic renal patients: follow up (esp. when co-morbidity) and prepare for kidney replacement therapy

- patients on peritoneal dialysis: monitor and redesign individual dialysis scheme (solely delivered at home)

- patients on hemodialysis: monitor individual dialysis adequacy and delivered dose - monitor home hemodialysis

- patients on wait-list for transplantation: monitor vital signs and monitor/ensure overall health condition

- transplanted patients: monitor adequate kidney function, health condition, adherence to prescription/diet
telematics for renal patients

- **1998 USA/Australia**: teleconsultations (hemodialysis)
- **2000-2007 Europe**: teleconsultations (hemodialysis & peritoneal dialysis)
- **2000 Japan/Europe**: telemetry of dialysis data
- ~**2005 companies of dialysis equipment incorporate telemetry in some home dialysis models**
- **2007 Greece**: integrated web-based service for telemonitoring and telemetry (home dialysis)
  - the PERKA service - Democritus University of Thrace and collaborating IT companies
problems in current approaches

- treatment method-centric approaches
  - emphasis on a single method, no continuous monitoring for patients switching between treatments

- data/disease-centric approaches
  - emphasis on disease monitoring, no real support for a mobile, active person in their everyday life

- clinically oriented approaches
  - emphasis on supporting management of the individual, no real support for overall management of the disease
problems in current approaches

- proprietary technical solutions
  - emphasis on proprietary software, no standardized interfaces or open, service oriented systems

- misleading evaluation of the technological intervention
  - the intervention is seen either as a “drug” or as an “unavoidable research project aftermath”
  - little emphasis on learning and improving
the PERKA service

- **main features**
  - web based service - web service architecture (with standard XML/SOAP interfaces)
  - data transfer via mobile telephony
  - dynamic, personalized measurement set-up by clinician (can be tailored to support monitoring requirements of different treatment methods)

- **current deployment**
  - region of East Macedonia and Thrace, Greece
  - [https://portal.perka.gr/](https://portal.perka.gr/)
PERKA

PERKA Data Center
- patient data
- data collection & data processing
- Web Service

PERKA portal

Internet

Patient Unit
- medical devices

HTTPS

XML/SOAP

telemetry data

administrative & portal data

MEDICON 2010, May 27-30, 2010
patient unit
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- **Ασθενής**: Αλλαγή APD
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- **Χρονικό Παράθυρο**: 480.00 min
- **Τύπος Προγραμματισμού**: Εβδομαδιαίο
- **Κάθε**: 1.00
- **Είδος Λήξης**: Χωρίς Τέλος

**Περιγραφή Περιγραφής**

- Αλλαγή APD (24)
- Αλλαγή APD (24)
- Αλλαγή APD (24)
- Αλλαγή APD (24)
- Αλλαγή APD (24)

**Home**

- Ασθενείς
- Μέτρησες
- Ειδοποιήσεις - Συναγερμοί
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evaluating PERKA within context

- evaluation draws on interpretivism (subjectivism)

- emphasis on trying to understand the context of the service, and the process whereby this service influences and is influenced by its context

- based on a two-dimensional evaluation framework (adapted from Cornford T, Doukidis GI, Forster D. - 1994)

  - study structure, process, and outcome
  - for the service functions, human users, and organizational context
# Evaluation Framework by Cornford et al

<table>
<thead>
<tr>
<th></th>
<th>System functions</th>
<th>Human perspectives</th>
<th>Organizational context</th>
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</thead>
<tbody>
<tr>
<td><strong>Structure</strong></td>
<td>technical detail</td>
<td>changed work conditions and implied requirements</td>
<td>sustainability, opportunity costs, management needs, skill requirements</td>
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<tr>
<td><strong>Process</strong></td>
<td>information processing correct and valid</td>
<td>human participation in tasks; social interaction</td>
<td>altered delivery and practice</td>
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<tr>
<td><strong>Outcome</strong></td>
<td>relevant, applicable, reliable</td>
<td>quality of service and outcomes</td>
<td>effect in the world</td>
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*Cornford T, Doukidis GI, Forster D. (1994)*
### adapting the framework for home telecare

<table>
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<th>Human perspectives</th>
<th>Organizational context</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>what are the real hardware and software requirements; does the full set of system components work together in a technical sense?</td>
<td>Physicians</td>
<td>Patients</td>
</tr>
<tr>
<td>Process</td>
<td>is the method by which the system transforms its data, the information processing, correct and valid?</td>
<td>how was the user’s mode of operation changed? Are these changes seen as desirable to the user as an individual, and in general to the user’s organizational role?</td>
<td>how is the patient’s experience of health care altered at the point of contact with the system?</td>
</tr>
<tr>
<td>Outcome</td>
<td>are the results relevant, applicable and reliable? Does it meet the requirement specifications?</td>
<td>was the overall effectiveness of the clinician within the health care system enhanced?</td>
<td>does the use of the system result in changes in the quality of service and better health for the patient?</td>
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evaluating PERKA

phase 1
during design, development and prototype pilot implementation
- 18 months of design, development, lab testing (Oct. 06 – Mar 08)
- 3 months of pilot implementation (Apr 08 – Jun 08)
- access function and incorporate user requirements

phase 2
deployment as experimental clinical protocol
- 24 months of experimental deployment (Dec 08 – Nov 10)
- ~10 patients in a regional setting
- to assess user satisfaction and clinical outcome
progress beyond the state-of-the-art

requires

- model and integrate context
  - health and social context
  - for patients and healthcare personnel

- integrate patient education via participative approaches

- provide tools for overall disease (not only patient)
  monitoring, management and planning (coupled to real-time disease monitoring)
acknowledgement

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- “Novel System for Monitoring Renal Failure”, Desmi 2008, Republic of Cyprus & the European Regional Development Fund
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