An open access platform for creating and publishing open source, executable, models of best clinical practice ("publets")
The knowledge ladder

- Symbols
- Concepts
- Descriptions
- Rules
- Decisions
- Plans
- Agents
PROforma: executable models of tasks and processes
Modelling expertise
Example: multidisciplinary decision making
Vivek Patkar, Ioannis Chronakis, Dionisio Acosta, Mo Keshtgar, J Fox BMJ Open, 2012

5.1 Introduction
A proportion of patients with early invasive breast cancer will have occult metastatic disease at the time of diagnosis and will relapse at a later date. The purpose of adjuvant systemic treatment is to reduce this risk. Adjunct therapy options include endocrine treatments, chemotherapy and targeted biological agents such as trastuzumab. Please see page 53; the selection of these treatments needs to be carefully assessed in the context of these patients' age, tumor biology, personal and familial risk factors, and comorbid conditions.
Example: smart care pathways
Peleg et al, *Endocrine Practice*, 2015
<table>
<thead>
<tr>
<th>Clinical tasks</th>
<th>Trials and evaluations</th>
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<tr>
<td>Mammographic screening</td>
<td>Taylor et al, <em>Medical Image Analysis</em> 1999</td>
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<td>Genetic risk assessment</td>
<td>Glasspool et al, <em>J Cancer Education</em> 2010</td>
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<td>Multidisciplinary decision making</td>
<td>Patkar et al, <em>BMJ Open</em> 2011</td>
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<td>Investigation, diagnosis of thyroid</td>
<td>Peleg et al, <em>Endocrine Practice</em> 2015</td>
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<td>Diagnosis and treatment of stroke</td>
<td>Ranta et al, <em>Neurology</em> 2015</td>
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<td>Shared decision-making chemotherapy</td>
<td>Miles et al, <em>BMJ Open</em> 2017</td>
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<tr>
<td>Diagnosis of hyponatremia</td>
<td>Gonzales et al, <em>Int J Med Informatics</em> 2017</td>
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</table>
Scaling up
Scale and scope of medical practice

1. Diseases and conditions (14,000-100,000)
2. Decision types (diagnosis, treatment, prescribing … > 20)
3. Users (GP, specialist, nurse, pharmacist, patient … > 20)
4. Kinds of care pathways (> 20)
5. Co-morbidities and polypharmacy (*potentially exponential*)
6. Local hospital and service variants (*indefinite*)

100,000 -10,000,000 individual “apps”?
Crowd sourcing executable models: publets

Proc. AMIA 2001

https://musescore.org/en
OpenClinical authoring tool: *Tallis*

info@openclinical.net

Bespoke platform for Open Access and Open Source publishing on OpenClinical

*in development*
**Guideline:** Royal College, Physicians

**Author:** Annick Labadie, University of Oxford

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**Anticoagulation Therapy Decision**

**Treatment Specifications:**

- **Life-threatening patients:** Anticoagulation treatment should be recommended in every patient with venous or pulmonary embolism (valvular and non-valvular).
- **Eligible patient:** Anticoagulation treatment should not be used for patients with atrial fibrillation unless a major confounding source of embolism has been identified.
- **Treatment onset:** Anticoagulation treatment should not be started until 3 days have passed from the onset of disabling ischemic stroke.
- **Patients with recurrent TIA or stroke:** Should be managed in the same way as those who had a single event. More intensive antihypertensive therapy and anticoagulation should only be given as part of a clinical trial or in exceptional clinical circumstances.
- **Patients identified with cortical venous sinus thrombosis:** Should be given full-dose anticoagulant (initially full-dose heparin and then warfarin [INR 2–3]) unless there are complications that preclude use.
- **Patients with stroke secondary to acute arterial dissection:** Treated with other anticoagulants or antplatelet agents, particularly as part of a randomised controlled clinical trial to compare the effects of the two treatments.
- **Patients with antiphospholipid syndrome:** Those who have had an acute ischemic stroke should be managed in the same way as people with acute ischemic stroke without antiphospholipid syndrome.

The guidelines do not specify if treatment onset for patients with central venous sinus thrombosis or acute arterial dissection is the same as for other patients. Guidelines also do not specify if patients with recurrent stroke must have antiplatelet or anticoagulation to be administered.

**Candidates:**

- **Anticoagulation treatment is not recommended or may not be started at present** (Score: 5,0)
  - A minimum of 64 days from onset of disabling event have not yet passed. (Weight: 4,0)
  - Patient has antiphospholipid syndrome, and should be treated the same way as a patient without antiphospholipid syndrome. (Weight: 1,0)
- **Anticoagulation therapy is recommended** (Score: 4,0)
  - Patient has antiphospholipid syndrome, and should be treated the same way as a patient without antiphospholipid syndrome. (Weight: 4,0)
Example cancer pathways
Vivek Patkar, breast surgeon (Cancer Research UK)
Repertoire alpha (2015)
Emergency medicine pathways by Marc Gutenstein MD
Skip options

Learning health system  Ecosystem  Forward plan  Publications  Quit
Learning from experience
Openclinical as a model for rapid learning systems in healthcare

Guidelines, pathways, quality standards
(e.g. NICE, NGCH)

Formalise

Machine executable Knowledge models
(e.g. PROforma)

Analytics learning

Patient data

Point of care Services
(clinic, home, mobile)

Localise, Personalise

Open access, open source publets
(e.g. OpenClinical)

Publish
### Proof of concept: Alpha

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<th>Repertoire repository</th>
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<td>Private analytics</td>
<td>Revise</td>
<td>Public analytics</td>
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<tr>
<td>Skip options</td>
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<td></td>
<td>Publish</td>
<td>Learning (RLS)</td>
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</table>

### Phase 2: publishing

- **Submit**
  - Upload
  - Standards checks
  - Specialist reviews
  - Revise
  - Publish

### Phase 3: deploy?

- **Offer**
  - Adopt
  - Adapt
  - Integrate
  - Test

- **Licence**
  - Permissions
  - Liabilities
Key publications

**Application of Information Technology**

**The Syntax and Semantics of a Guideline Model**

**Abstract**

Medical knowledge is traditionally disseminated through participation in clinical or industry conferences, scientific journals, or direct marketing. The promise of this new mode of dissemination, via the internet, is that it will reach a much wider audience. The key concept here is the provision of a structured framework for understanding and interpreting guidelines. The framework provides a way for the development of an electronic knowledge base, which can be used by clinicians to support their decision-making. Such frameworks have the potential to improve the quality and consistency of clinical care, as they provide a standard for interpreting guidelines and ensuring that they are implemented in a consistent and effective manner.

**OpenClinicalNet: A platform for creating and sharing knowledge**

**Promoting best practice in healthcare**

**Abstract**

It is well known that medical knowledge is growing so rapidly that healthcare professionals need to keep up. More and more techniques for disseminating knowledge are becoming available, yet none of these techniques are as effective as the internet. The OpenClinicalNet platform is designed to facilitate the creation and sharing of knowledge in the healthcare domain. The platform provides a way for healthcare professionals to share their knowledge, with the goal of promoting best practice in healthcare. The key feature of the platform is the ability to create and share knowledge in a structured and standardized way, with the aim of improving the quality and consistency of clinical care.